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Structural and functional basis for disorders of the temporomandibular articulation

■ *Harry Sicher, M.D., D.Sc., Chicago*

The traumatic and degenerative disorders of the temporomandibular articulation are a well circumscribed entity. Subjective symptoms are pain, localized in the region of the joints or neighborhood—cheek, ear, temple, tongue or throat—and stiffness or feeling of tiredness in the masticatory muscles. Objective symptoms are soreness of joint muscles, limited mobility, snapping or rubbing noises in the articulation, and, frequently, damage that is visible in the roentgenogram. The pathologic changes are mainly of a degenerative nature and are localized in the fibrous covering of the articular eminence and mandibular condyle and in the fibrous articular disk.

Among etiologic factors are overclosure after loss or pathologic abrasion of teeth or after bone loss under dentures, premature contacts, mandibular displacement, and bruxism. A common denominator that underlies all these various factors has to be postulated, and its analysis must rest on a thorough knowledge of anatomic and physiologic factors. Unfortunately the literature shows that there is no agreement in this field. An attempt will be made herein to review old and new observations that may shed light on clinical problems and on problems of therapy.

■ *Relations Between Disk and Capsule*

The articular disk, an oval, biconcave plate of fibrous tissue, is sometimes described as fused along its thickened margin with the fibrous capsule, thus dividing the articular space into two compartments. This description is erroneous. Although the medial, anterior, and lateral edges of the disk are directly attached to, and fused with, the capsule, the posterior border of the disk is bound to the capsule by loose connective tissue, that in sagittal section often presents a triangular shape (illustration, left). In contrast to the

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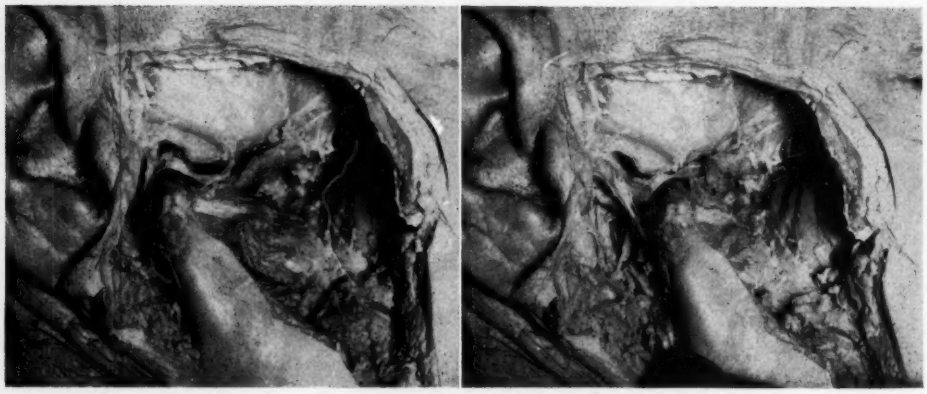

Left—Temporomandibular joint and external pterygoid muscle. Articulation has been opened; articular eminence and disk have been cut sagittally. Soft connective tissue between disk and capsule is visible. Right—Mandible has been moved forward. The disk followed the movement. Connective tissue behind disk is stretched

pressure bearing, and thus avascular and nerveless disk, this loose connective tissue is rich in blood vessels, nerves and nerve endings, the latter supplied by branches of the auriculotemporal nerve.

In contrast to the disk itself that has no covering of a synovial layer, the loose connective tissue between the disk and capsule is covered by synovia. This layer of tissue is extremely rich in blood vessels and is, of course, responsible for the elaboration of the synovial fluid, the lubricating and nutritional element of all articulations.

The significance of the loose attachment of the disk to the posterior capsule is evident if it is remembered that the movements of the disk are a forward and backward glide along the convex posterior and inferior surface of the articular eminence. A forward slide would be impossible or at least would be severely restricted if the loose connective tissue behind the disk did not stretch to allow the extensive movement of the disk (illustration, right).

The loose connective tissue between the disk and the posterior capsule is the most important point of low resistance and therefore is the most susceptible region for mechanical damage of the temporomandibular articulation.

■ *Relations Between Disk and Articulating Bones*

The great mobility of the articular disk as it bears against the temporal bone is clearly indicated by the looseness of the capsule of the upper compartment of the joint in its entire circumference. In contrast, the restriction of mobility between condyle and disk to a pure hinge movement is morphologically expressed in the presence of collateral ligaments in the lower compartment of the joint. The disk is attached to the medial and lateral pole of the condyle by strong and tight fibers that remain taut in all movements of the

mandible. The consequence of this relation is that the disk follows passively all sliding movements of the mandible (illustration, right).

This latter observation, easily confirmed on anatomic specimens, seems to contradict the generally accepted idea that the attachment of some fibers of the upper head of the external pterygoid muscle is responsible for the forward movement of the disk in protrusive or opening movements of the mandible; however, the following facts have to be considered.

The forward slide of condyle and disk is in reality a movement forward and downward. The direction of the fibers of the powerful lower head of the external pterygoid muscle is in agreement with the direction of mandibular movement. The pull of the weaker upper head, however, is directed forward and upward (and inward) and thus is at cross-purpose to the direction of movement. In addition the backward movement of the disk is clearly not effected by any muscle pull on the disk, but follows passively the retrusion of the mandible. Finally, it has already been mentioned that passive movements of the lower jaw in a fresh cadaver have shown the disk as following the mandible in all its movements.

Thus the inevitable conclusion is that the upper head of the external pterygoid muscle, and especially its attachment to capsule and disk, are not designed to bring about movement, but to maintain balance and to maintain the disk in contact with the temporal bone in a forward position on the oblique slope of the articular eminence.

Again it can be stated that the unilateral attachment of a muscle to the disk, although indispensable for the normal masticatory function, may become a liability if muscular correlation is disturbed.

■ *Mandibular Musculature*

The mandibular muscles, masseter, internal pterygoid, temporal, external pterygoid, digastric, geniohyoid and (least important) mylohyoid muscles, are a functional unit. In all movements of the lower jaw all these muscles act. Their combination and correlation, the assignment of their ever-varying roles in these movements as prime movers, positioners and balancers, is the function of the nervous system and is effected by constant reflex activity. This "feedback" originates in the sensory nerve endings in the muscles themselves, in their tendons, in the ligaments of the joint and, whenever teeth come into contact, by the proprioceptive nerve endings in the periodontal ligaments. Since the delicate balance and correlation of the musculature is of special importance to the function and the integrity of a freely movable joint, any disturbance of the regulatory mechanism may have serious consequences.

In this connection the following facts are of great importance. Overshortening of a muscle or an abnormally long sustained contraction leads to overstimulation of the nerve endings in the muscle itself. Fired back into the muscle by reflex arcs, the irritated state of a muscle maintains itself and, indeed, is gradually increased. The muscle thus may finally go into spasms and contracture. Since the musculature of the mandible is an indivisible unit, any irritation of any one of its members will inevitably influence others, and finally all the mandibular

muscles may fall into a spastic state.

In occlusal positions, a complicated pattern of proprioceptive stimuli is set up in the periodontal ligaments of all teeth that are in contact. Any aberration, even a slight one, from the normal alignment of the teeth will bring about a discordant note in the otherwise harmonious chord of stimuli. This discordant note cannot fail to influence the musculature that will try to re-establish normal relations, and in this futile task will work itself again into spasms and contractures.

It must also be remembered that mental disbalance may express itself in muscular hypertension, and it is an old experience that the mandibular musculature is especially sensitive to such disturbances, though the reason for this susceptibility is unknown. Bruxism in so-called "nervous" patients is a frequent occurrence.

Bruxism caused by trismus—that is, spasms of the mandibular musculature—whether as a consequence of overclosure, premature contacts or nervous tension, is, in the majority of patients, confined to sleep. Occasionally, however, high mental tension in concentrated work, for instance, during practice of musical instruments, can cause bruxism during the day.

■ *Mechanism of Initial Joint Disorder*

The spastic hyperactivity of the mandibular musculature may initiate degenerative changes in the temporomandibular joint merely by increasing and sustaining abnormal pressure on the fibrous tissues of the articulation. Clinical and pathologic observations, however, tend to show that in the majority of joint diseases a more complicated and more severely injurious mechanism is active.

Two facts in regard to the articular disk must be remembered; namely, the attachment of muscle fibers on its anterior rim, and the loose attachment to the capsule at its posterior edge. If the muscles of the mandible fall into spastic contractions or contracture, the unilateral muscle attachment eventually will cause a displacement of the disk with relation to the condyle. In the "fight" of the irritated muscles against each other, the disk may be held in place while the mandible is displaced posteriorly, or the mandible may be stabilized while the disk is displaced anteriorly, or more probably a combination of these possibilities becomes a reality.

The next consequence is an impingement of the condyle on the loose connective tissue behind the disk. An immediate consequence of this impingement is pain in this sensitive region, and later, inevitably, degeneration of the joint. The disk then loses its attachment to the posterior capsule and the loss of a wide area of synovial tissue leads to a loss of resistance of all of the tissues of the articulation that do not possess blood vessels but are supplied by the synovial fluid. Thus a vicious circle is initiated that finally may lead to a total breakdown of the joint.

Pain is not restricted to the articular structures but is also referred into adjacent regions. However, in most instances extra-articular pain is muscular pain, so well known as a symptom of muscle spasms. Pain in the region of ear and temple is pain in the temporal muscle, pain in the masseter muscle causes pain in the cheek, pain in the pterygoid mus-

cles is localized by the patient in the throat, and pain in the digastric and geniohyoid muscles is localized to the tongue.

■ *Summary and Conclusions*

1. The disk of the temporomandibular articulation is immediately attached to the fibrous capsule on its medial, anterior and lateral aspect. Its posterior border, however, is attached to the capsule by loose connective tissue, rich in blood vessels and nerves.

2. The disk is firmly attached to the medial and lateral poles of the condyle and, therefore, follows passively the movements of the mandible.

3. The unilateral attachment of the external pterygoid muscle to the anterior border of the disk serves to stabilize the disk rather than to give it movement.

4. The mandibular musculature is a functional unit, harmonized, correlated, and balanced by a delicate feedback mechanism. The regulating reflexes originate in the proprioceptive nerve endings in the muscles, the articulatory capsule, and the periodontal ligaments.

5. Any disturbance of the proprioceptive signals may lead to overexcitation of the mandibular musculature, trismus and bruxism. Such disturbances are self-perpetuating and self-aggravating.

6. Overclosure, premature contacts and mental tension are the most frequent causes of proprioceptive imbalance.

7. The degenerative changes in the joint are initiated by a dislocation of the lower compartment of the joint caused by the unilateral pull of the external pterygoid muscle on the disk.

8. Local pain is caused by pressure of the condyle on the loose connective tissue behind the disk. Pain in the surrounding region is primarily muscular pain.

■ Basic Research

The term research is itself a source of confusion. Research means simply a careful systematic or diligent search for facts or principles. It comes from an old French expression meaning "to seek again." In general and proper usage, one finds library research, historical research, legal research, industrial research, clinical research, and scientific research. *Scientific* is no more a necessary adjective for *research* than *damn* is for Yankee! Scientific and basic research are special restrictions of the general term. *Ward Pigman, "Wanted: More Ivory Towers," The Scientific Monthly 80:253 April 1955.*

Diphenylhydantoin sodium hyperplasia: hydrocortisone acetate as an adjunct in its treatment

■ *Melvin Spira, D.D.S., M.S.D., Augusta, Ga.*

Diphenylhydantoin sodium (Dilantin Sodium) has been used extensively in the treatment of epilepsy since the introduction of the drug in 1938. When used alone, or with other anticonvulsants, it has proved effective in the control of grand mal seizures; however, undesirable pharmacologic effects of the drug are often encountered. Vertigo, nausea, blurred vision, gastrointestinal and skin irritations, and cardiovascular disturbances are among the untoward effects of this and other antiepileptic drugs. An effect peculiar to diphenylhydantoin sodium is the gingival hyperplasia or hypertrophy which follows its administration. This condition is most frequently encountered in susceptible patients after continuous administration of the drug over long periods of time. With adequate sedation, many of the side effects can be avoided, but the gingival involvement remains as a problem both to the patient and the dentist.

The present observations were made on 52 institutionalized, mentally defective persons with epilepsy. All grades of defective mentality were represented, with a predominance of the higher type (morons). Gingival hyperplasia was present in about 70 per cent of the patients (see table). The majority of these patients suffered from moderate to severe involvement. The condition appeared to manifest itself more often in the younger age group and the degree of hyperplasia varied directly with the dosage of diphenylhydantoin sodium. The patients who showed considerable hyperplasia had received, on the average, twice the amount of the drug as had those who exhibited none.

There appeared to be some correlation between the degree of oral hygiene and the severity of the gingival condition. The majority of the patients with hyperplasia generally exhibited poor oral hygiene, although in several patients—bedridden idiots with no semblance of oral hygiene—hyperplasia was not demonstrable. Since these patients had been maintained on large dosages of the drug over long periods of time, there apparently is an inherent predisposition to the condition. Thus the pathogenicity is complex, and the etiologic factors for this rather unusual reaction have never been established.

■ *Review of Literature*

In diphenylhydantoin sodium hyperplasia, gingival involvement is variable and

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The hydrocortisone acetate dental ointment used in clinical trial furnished through the courtesy of Medical Division, Merck & Co., Inc., Rahway, N. J.

Table

Gingival hyperplasia in 52 mentally defective persons with epilepsy

Group	Hyperplasia	Average age	Diphenylhydantoin sodium—av. daily dose (mg.)	Oral hygiene			Total	Per cent
				Poor	Fair	Good		
A	Moderate-severe	19	300	13	5	4	22	42.3
B	Mild	21	215	6	1	7	14	26.9
C	None	22	150	5	4	7	16	30.8
							52	100.0

may resemble a true vitamin C deficiency. Various investigators have called attention to ascorbic acid deficiency as an etiologic factor. Kimball,[1] who first described diphenylhydantoin sodium hyperplasia, stated that low ascorbic acid levels in the blood of patients receiving the drug led to the development of the overgrowths. Drake and co-workers[2] demonstrated low ascorbic acid levels in the tissues and peripheral blood of rats who had been treated with diphenylhydantoin sodium. Strean[3] also found that the use of ascorbic acid as supplemental to adrenal cortical steroids was of value in the control of this type of hyperplasia. He presented evidence that in severe cases, diphenylhydantoin sodium suppressed adrenal cortical activity, and since this gland is rich in vitamin C, a deficiency of this vitamin could result. Merritt and Foster,[4] however, stated the belief that low ascorbic acid levels are not commonly found in these patients, and that vitamin C does not influence the development or regression of the hyperplasia.

Staple[5] published evidence of deranged adrenal cortical function in rats after treatment with diphenylhydantoin sodium and postulated that the gingival hyperplasia seen in human beings might be an exaggerated tissue response to injury (presence of deposits, irritating fillings, and so on).

■ *Clinical Manifestations*

The clinical manifestations of diphenylhydantoin sodium hyperplasia and hypertrophy are well described by Burket.[6] Grossly, the lesions vary from slight to severe hyperplasia of the gingiva, and occur only in the dentulous areas. These lesions generally are firm, nontender, lobulated overgrowths and show relatively slight tendency to hemorrhage. In patients in whom the hyperplasia is more advanced, the gingiva may cover the coronal portions of the teeth completely, remain tender and bleed on the slightest provocation. A nonspecific gingivitis is often present.

Microscopically, there is a thickening of the gingival epithelium with considerable epithelial hyperplasia. Parakeratosis, hyperkeratosis, elongated epithelial rete pegs and epithelial pearl formation are often observed. Although hyperplasia is usually evident, hypertrophy is also pres-

1. Kimball, O. P. Treatment of epilepsy with sodium diphenyl hydantoinate. J.A.M.A. 112:1244 April 1, 1939.

2. Drake, M. E., and others. Effects of sodium diphenyl hydantoinate (dilantin) on vitamin C level in tissues and vitamin C excretion in rats. J. Pharmacol. & Exper. Therap. 71:268 March 1941.

3. Strean, L. P. Personal communication.

4. Merritt, H. H., and Foster, A. M. Vitamin C in epilepsy. Dilantin sodium not cause of vitamin C deficiency. Am. J. M. Sc. 200:541 Oct. 1940.

5. Staple, P. H. Adrenal glands and gingival hyperplasia due to phenytoin sodium. Lancet 265:600 Sept. 1953.

6. Burket, L. W. Oral medicine. Philadelphia, J. B. Lippincott Co., 1946.

ent when the condition is aggravated by poor oral hygiene. There is mucosal fibrosis, edema and collagenization, with chronic inflammatory infiltrate in the lamina propria.

■ *Treatment*

Treatment of this condition generally is dependent on the degree of hyperplasia. In instances where the condition is relatively mild, conservative measures are in order. Regular, thorough prophylaxis and a strict home oral hygiene regime should be instituted. The patient must be taught an adequate toothbrushing technic, with special attention to interdental stimulation and gingival massage.

Hydrocortisone acetate dental ointment 2.5 per cent has been reported as of value when used in conjunction with gingival massage in instances where the hyperplasia is not pronounced.[7] It is theorized that the hormone is absorbed through the mucous membrane, and that it thereby suppresses the inflammatory process and inhibits fibroblastic proliferation. Similar preparations have been used successfully in the treatment of a variety of dermatologic conditions.[8] If diphenylhydantoin sodium suppressed adrenal cortical activity, then the application of the ointment might serve as a beneficial local substitute for the activity. Adjustment of the occlusion to eliminate areas of stress and the removal of other irritating factors such as overhanging fillings and defective crowns are other procedures of value.

If the hyperplasia has progressed to the extent of moderate to severe gingival overgrowth, a different approach is necessary, since in such instances, the condition generally is refractory and will not respond to conservative treatment. Even with discontinuation of the drug and transfer of the patient to some other medication, there is little, if any, regression of the hyperplasia.

After thorough scaling of the teeth, the hyperplastic gingival tissue can be removed best either with electrocautery or with the scalpel. The procedure is essentially the same as that carried out for the elimination of pockets in the treatment of periodontal disease, but on a more extensive basis. The hyperplastic tissue covering the coronal portions of the teeth and any excessive associated tissue should be excised. The removal of less than adequate amounts of the overgrowth is a common fault. With healing, the second phase in the control of this condition should be followed.

An effort should be made either to discontinue the drug, substituting Mesantoin, or reduce the dosage. Mesantoin is reputedly as effective as diphenylhydantoin sodium in the control of grand mal seizures, and does not induce gingival hyperplasia as a side effect. If the attacks are of the petit mal variety, then trimethadione (Tridione) and paramethadione (Paradione) may be substituted, with excellent results. Indeed, they should be the drugs of choice in these cases. If, however, substitution of the drug is not practical, other methods should be attempted. Gingivectomy, as an isolated procedure, is ineffectual, as regrowth is rapid. All of the factors mentioned in the conservative treatment of the milder cases are impor-

7. Strean, L. P., and Horton, C. P. Hydrocortisone in dental practice. D. Digest 59:8 Jan. 1953.

8. Sulzberger, M. B., and others. Hydrocortisone (compound F) acetate ointment in dermatological therapy. J.A.M.A. 151:468 Feb. 1953.

tant and should be carried out to the limit of practicability.

■ *Use of Hydrocortisone Acetate*

As already mentioned, the use of hydrocortisone acetate as an ointment in the control of hyperplasia after gingivectomy has been reported as effective.[7] In order to investigate its value, it was used experimentally in four patients and two patients were used as controls. All of the patients were mentally defective adolescents or young adults. They were chosen from a larger group (Group A, table) and represented various levels of mentality ranging from high grade to low grade. All had been on diphenylhydantoin sodium for several years, and presented similar problems in maintaining good oral hygiene treatment.

Each patient received a thorough prophylaxis. In each instance gingivectomies were performed and the tissues allowed to heal completely. Hydrocortisone dental ointment 2.5 per cent was applied three times daily after each meal, in each of the experimental cases. Approximately one half inch of this medication as expressed from the tube was massaged into each quadrant for three minutes. This was a regular ritual (except where noted) and, in order to obviate individual differences in the manner of application, the massage was carried out by a dental assistant. In both groups every effort was made to maintain an acceptable degree of oral hygiene.

■ *Report of Cases*

CASE 1—A 15 year old white girl, when first seen, presented the typical picture of diphenylhydantoin sodium hyperplasia. The condition was especially pronounced in the upper anterior region. The gingiva was hyperplastic, firm, nontender and exhibited no noticeable bleeding tendencies. She and her family were extremely conscious of the condition, and the patient appeared most cooperative when informed of the experiment. Full-mouth gingivectomy was performed, a quadrant at a time (Fig. 1, above left and right).

The patient was instructed to use the ointment, applying it herself as directed. Unfortunately she could not be watched daily and was found to be neglecting the procedure. Figure 1, center left, shows the regrowth two months after the original surgical removal of the hyperplastic tissue. At that time it was felt that the whole procedure could be controlled better if someone else applied the ointment. Gingivectomies were again performed, with excellent result (Fig. 1, center right). Over four months later, with daily applications of hydrocortisone acetate ointment, there was only the slightest regrowth (Fig. 1, below left). The gingival massage was discontinued at the time in order to permit regrowth to occur. Two months later there was a noticeable remission (Fig. 1, below right).

CASE 2—A white girl, 15 years old, had generalized moderate hyperplasia that was especially noticeable in the lower anterior region. As with Case 1, a strict regime of oral hygiene was adhered to. There was considerable improvement in color and tone of the gingiva after two weeks of massage with the hydrocortisone acetate ointment. Approximately four months later, the gingiva appeared normal except for a few relatively minor isolated areas of hyperplasia. Although it was felt

that these hyperplasia regions could easily be removed, for the benefit of the clinical trial, this was not done.

CASE 3—A 15 year old white boy had the same degree of hyperplasia as had Case 1. Slight regrowth was evident within a period of a few weeks. The patient was then started on hydrocortisone acetate ointment. Further regrowth was noted three months later. Supplemental ascorbic acid, 1.0 Gm. daily, was prescribed in addition to the gingival massage. The addition of vitamin C to his diet did not materially affect the regrowth.

CASE 4—A 22 year old white man was uncooperative, and the maintenance of satisfactory oral hygiene was not successful. The preoperative and postoperative pictures are shown in Figure 2. Six weeks postoperatively there was definite beginning regrowth. The patient's general nutritional status was poor, and a

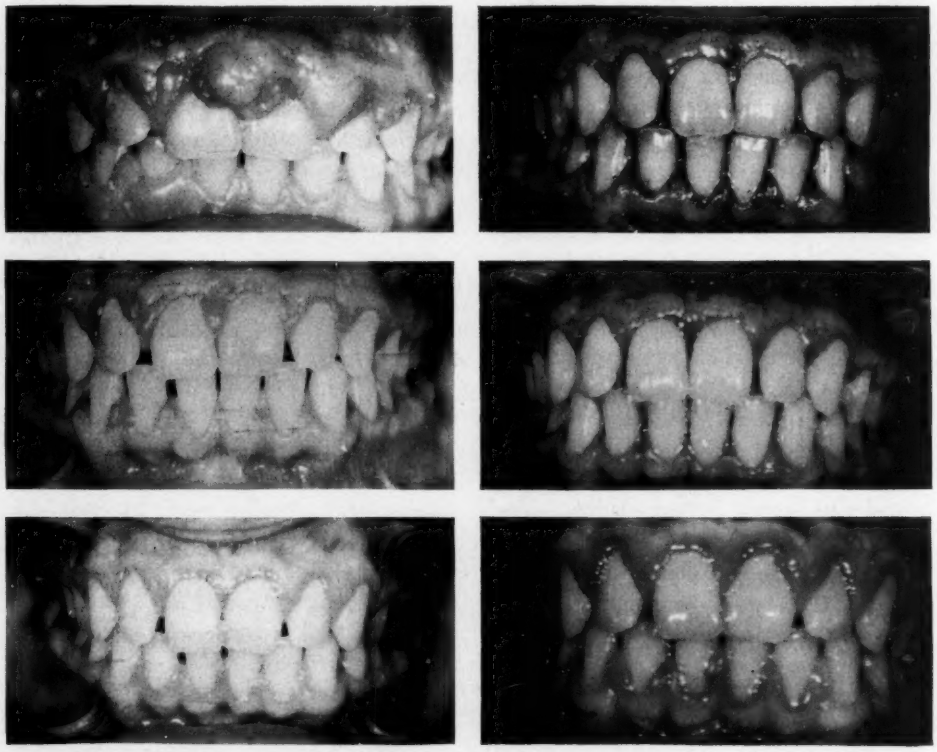

Fig. 1—Case 1. Above left: Preoperative view. Above right: Postoperative view. Center left: View two months later, showing regrowth. Center right: View after second series of gingivectomies. Below left: Four months later, after treatment. Slight hyperplasia can be seen. Below right: Two months after discontinuation of treatment. Regrowth present

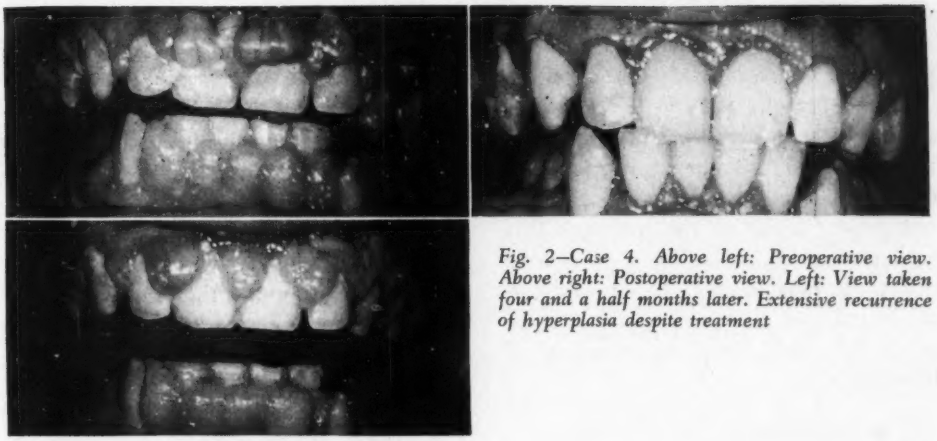

Fig. 2—Case 4. Above left: Preoperative view. Above right: Postoperative view. Left: View taken four and a half months later. Extensive recurrence of hyperplasia despite treatment

vitamin C deficiency was suspected. In this instance the 24 hour urinary ascorbic acid output determination was made and found to be within normal limits. Notwithstanding this fact, the patient was started on 1.0 Gm. of ascorbic acid daily. As with Case 3, this supplement did not prevent continued regrowth, and four and one half months later there was extensive regrowth (Fig. 2, left).

CASE 5—An 18 year old white boy was used as a control patient; that is, no hydrocortisone dental ointment was used. Maxillary and mandibular gingivectomies were done, but these were followed by prompt recurrence of the hypertrophy.

CASE 6—A 17 year old white girl was also used as a control patient. Gingivectomies were performed only on the upper arch. The severest form of diphenylhydantoin sodium hyperplasia was present preoperatively (Fig. 3, left). Four months postoperatively, there was almost complete regrowth (Fig. 3, below).

COMMENT ON CASES—In reviewing these six cases, it is difficult to draw clear-cut conclusions. The age, sex, mental capacity, degree of oral hygiene, and amount and duration of administration of diphenylhydantoin sodium, and an apparent inherent predisposition to the hyperplasia, are all variables which make evaluation difficult. It appears that the hydrocortisone acetate ointment, massaged into the gingiva, proved to be of value in two instances, of questionable value in one, and of no help in the remaining patient. In the two control cases, regrowth was generally more extensive and occurred earlier than in the experimental group. Although this adjunct to therapy did not, in any instance, completely prevent any recurrence of the hyperplasia, there appeared to be sufficient inhibition of regrowth and improvement in tone of the gingiva to make it worth the time, effort and expenditure involved in its use. Where this medication was of value, rapid regrowth occurred when it was discontinued. In this particular study, the

use of supplemental ascorbic acid did not materially affect the course of the hyperplasia.

The use of mentally defective children, which meant lack of full cooperation, presented many difficulties. The type of epileptic usually encountered would not present many of the problems that were confronted in this study, or at least not to the same degree. This would certainly enhance the prospects of a more successful result from the treatment of this condition.

■ *Discussion*

Diphenylhydantoin sodium hyperplasia has remained a perplexing problem since this drug was first introduced as an effective therapeutic agent for the control of epilepsy. Not all patients treated with the drug develop these side reactions; usually, in the absence of proper mouth hygiene, gingival hypertrophy is superimposed on the gingival hyperplasia.

If Staple's observations in experimental animals can be translated to human beings, then suppression of adrenal cortical activity may be an etiologic factor to be considered in the treatment of this condition. Since the adrenal cortex is the source of cortisone or hydrocortisone and this gland is the biggest storehouse of vitamin C in the body, it is reasonable to suppose that a deficiency of this hormone and this vitamin may exist in the gingiva. The inflammation and fibroblastic proliferation would support this view. Added to these factors is the physiologic stress resulting from epilepsy —a matter to be considered in light of the adaptation syndrome of Selye.[9]

Since hydrocortisone acetate is a powerful anti-inflammatory agent and also inhibits fibroblastic proliferation, it would appear rational to use this hormone as a therapeutic agent. Massaging the oint-

9. Selye, H. General adaptation syndrome and the diseases of adaptation. J. Clin. Endocrinol. 6:117 Feb. 1946.

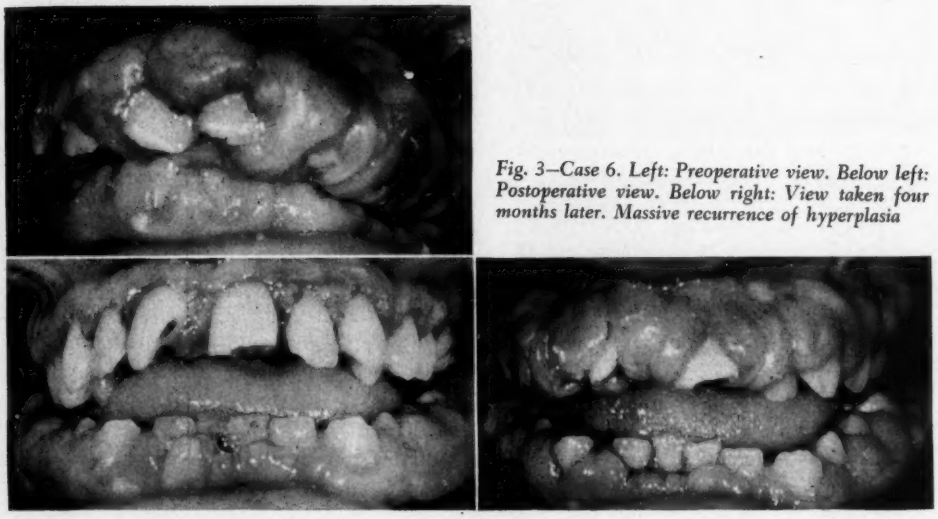

Fig. 3—Case 6. Left: Preoperative view. Below left: Postoperative view. Below right: View taken four months later. Massive recurrence of hyperplasia

ment into the gingiva permits local absorption of the material without the possibility of undesirable physiologic effects from overdosage.

The role of vitamin C in this condition is not clear. On a theoretical basis, daily dosage of this vitamin should aid in the control of the gingival hyperplasia. In practice, however, only a few patients show benefit from this treatment, and in this study none were benefited by the use of vitamin C.

The patients who responded to the therapy with hydrocortisone acetate after gingivectomy were those who cooperated in the treatment. Those who did not respond as well were those whose gingiva and oral hygiene did not receive adequate attention. The control patients serve to prove an important point—that without treatment with hydrocortisone acetate dental ointment, regrowth of the gingiva is observed soon after gingivectomy has been performed.

■ *Summary*

Hydrocortisone acetate dental ointment for the treatment of diphenylhydantoin sodium hyperplasia after gingivectomy was used in six patients. Four patients were treated with the hormone and two were considered controls. Two of the treated patients showed considerable improvement, one showed only slight improvement and the fourth showed no improvement. The latter two patients did not cooperate as well as the former. The two control patients developed regrowth soon after gingivectomy.

Hydrocortisone acetate dental ointment appears to be a useful adjunct in the treatment of diphenylhydantoin sodium hyperplasia.—3-*D Country Club Apartments.*

Lingual ridge extension

■ *Jack B. Caldwell, D.D.S., M.Sc., San Francisco*

An operation for deepening the lingual sulcus has been developed that permits extension of the lingual periphery of the lower denture and provides stability in instances where alveolar resorption and atrophy of the mandible make construction of satisfactory complete dentures virtually impossible.

Trauner's[1] operation prompted development of the technic described in this paper. Although the principles involved are similar, the methods of attaining the

Colonel, Dental Corps, U.S. Army; formerly, chief of oral surgery section, Dental Service, Walter Reed Army Hospital, Washington, D. C.; presently, chief of oral surgery section, Letterman Army Hospital.

1. Trauner, R. Alveoloplasty with ridge extensions on the lingual side of the lower jaw to solve the problem of a lower dental prosthesis. Oral Surg., Oral Med. & Oral Path. 5:340 April 1952.

Fig. 1—Cross section through third molar region in dry specimen of an atrophic mandible showing shelflike projection of mylohyoid ridge

end results differ materially. Trauner exposes the mylohyoid muscles through an incision in the mucosa lingual to the crest of the ridge and "bisects" the muscle. He stresses the importance of leaving the periosteum intact. The deeper areolar connective tissues are bluntly "pushed off with the finger or a tampon." The mucosa of the floor of the mouth and mylohyoid stumps are then fixed to the skin at the inferior border of the mandible by mattress sutures. He states that the:

> . . . lingual periosteum covered side of the mandible slants outward more or less which is favorable for denture retention . . . and . . . the lingual bone will be covered in a few weeks with granulation tissue and, finally, in about two months with epithelium.

Kazanjian[2] in 1940 described extension of the mandibular alveolar ridge on the buccal and labial aspects. More recently Cooley[3] reported a similar operation in which the mental branch of the inferior alveolar nerve had been lowered so as to attain extension buccally. He also recommends lingual frenotomy, with a lowering of the genioglossus muscle attachments. Except for the use of split-thickness skin grafts to line deepened buccal and labial sulci, and the more recent application of metallic implants to stabilize dentures, little else has been done to assist the prosthodontist in his occasionally futile attempt to cope with this difficult problem.

■ *Anatomic Considerations*

A brief review of the anatomic considerations involved in deepening the lingual sulcus for denture extension will show clearly that the mylohyoid ridge should be excised. In all mandibles which have atrophied to such an extent that surgery is justified, there is a sharp, shelf-like ridge which projects lingually. This ridge is parallel to the mandibular crest posteriorly, and is frequently on the same level, depending on the degree of atrophy (Fig. 1). This mylohyoid ridge is greatly accentuated in the atrophic mandible. In its course anteriorly, it is inclined downward toward the lower border of the mandible and becomes less prominent. Sicher[4] describes the mylohyoid niche as:

> . . . a concavity on the medial surface of the mandible . . . which is bounded above by the mylohyoid muscle plate (under surface of the mylohyoid ridge) and the medial surface of the mandible.

The mylohyoid muscle is attached to the entire length of the mylohyoid ridge along its lingual crest and to its under

2. Kazanjian, V. H. The surgical treatment of abnormalities of edentulous alveolar processes and palate. Am. J. Orthodont. & Oral Surg. 26:263 March 1940.

3. Cooley, D. Orr. Method for deepening the mandibular and maxillary sulci to correct deficient edentulous ridges. J. Oral Surg. 10:279 Oct. 1952.

4. Sicher, H. Oral anatomy, St. Louis, C. V. Mosby Co. 1949, p. 140.

surface. The fibers are directed downward and medially, and are joined by those of the opposite side in the mylohyoid raphe except for the posterior fibers which attach to the hyoid bone.

The shelflike projection of the mylohyoid ridge in the molar region, sharp in atrophic mandibles and with friable thin mucoperiosteal covering, forms a boundary which limits extension of the lingual denture periphery (Fig. 2). In addition, the mobility of the mylohyoid muscle during functional movements will dislodge a denture which extends beyond the afore-mentioned boundary. The musculature that is attached to the labial and buccal aspects of the mandible may also be attached at the level of and parallel to the crest of the ridge. Patients learn to use these lateral muscles, however, in the control, retention, and masticatory manipulation of unstable lower dentures. It is concluded, therefore, on the basis of the anatomy involved, that if ridge extension is indicated, it is best accomplished on the lingual aspect of the mandible where it is possible to obtain definite lateral stability.

■ *Operative Technic*

Surgical excision of the prominent mylohyoid ridge has been routine practice in the Walter Reed Army Hospital dental clinic for several years. Until recently, however, no effort had been made to provide a deeper lingual sulcus. Excision of this sharp, shelflike ridge alone provides a more suitable denture-bearing surface which frequently will suffice. The same approach is used when the sulcus is deepened, but additional surgical steps are required.

EXCISION OF THE MYLOHYOID RIDGE —An incision is made along the middle of the crest of the alveolar ridge from the retromolar pad to the first bicuspid or cuspid region. It must be sufficiently toward the buccal to assure a table of bone to which the lingual mucoperiosteal flap can be returned for closure of the wound after excision of the mylohyoid ridge. Also, this incision must be made through the periosteum to the bone, so that the periosteum will elevate readily and be included in the lingual flap.

It is essential that a broad, sharp elevator be used to detach the periosteum from the bone. A Molt no. 4 curet is ideal for this purpose. As the mucoperiosteal flap is elevated with the sharp instrument, it is reflected with a broad blunt retractor to assure good vision of the operative field. The attachments of the mylohyoid muscle can be seen when the sharp projection of the mylohyoid line is reached. These muscle attachments are

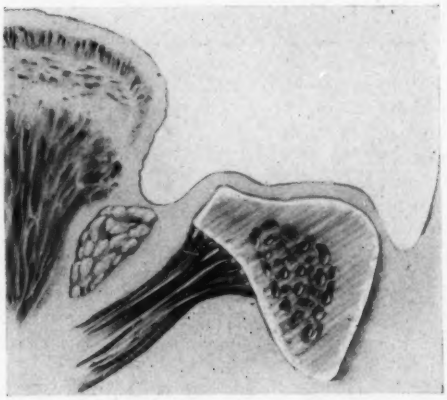

Fig. 2—Cross section through third molar region which shows relative position of mylohyoid muscle to mandible

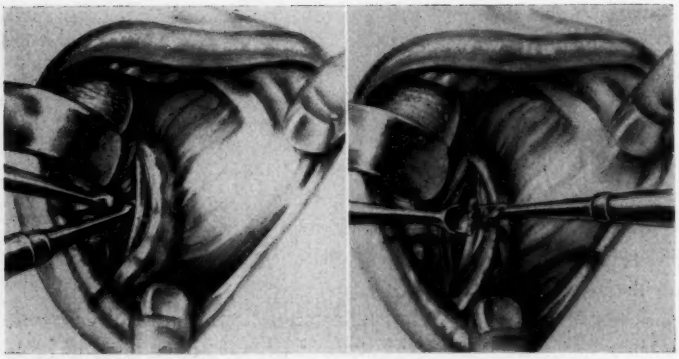

Fig. 3—Left: Mylohyoid ridge with its muscle attachments is exposed through long incision made over crest of alveolar ridge. Right: Broad, flat, long-beveled, sharp bone chisel is used to excise shelf of mylohyoid ridge

severed from the bone with the sharp blade of the curet whose rounded back surface is kept to the flap, and whose sharp edge is kept firmly in contact with the bone (Fig. 3, left). Since the flap is thin and easily perforated, great care must be exercised to protect it.

The sharp blade is carried horizontally beneath the shelf of the mylohyoid ridge, and the blade is kept in contact with the ridge at all times to assure severance of all the muscle attachments. Once this has been accomplished, the shelf of bone is excised with a broad, flat, long-beveled, sharp bone chisel and mallet (Fig. 3, right). The no. 3 Stout chisel is excellent for this purpose.

The soft tissues are protected by holding a blunt retractor in contact with the medial surface of the mandible below the shelf of the ridge. This is advisable during the excision of the bone. Irregularities that remain after the bulk of the ridge is removed may be smoothed with a bone file (Fig. 4). When ridge extension is not necessary, a narrow elipse of the soft tissue flap is excised to avoid excessive redundant tissue over the ridge (Fig. 5, above).

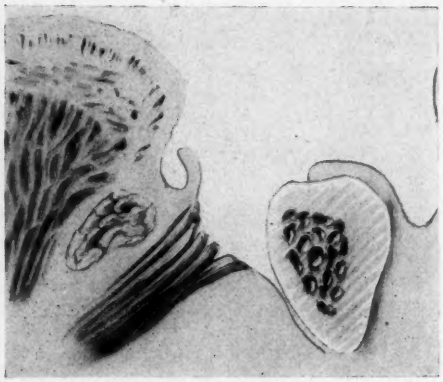

Fig. 4—Cross section of mandible in third molar region after mylohyoid ridge has been excised

DEEPENING OF THE LINGUAL SULCUS —If it is desirable, the floor of the mouth can be lowered and the lingual sulcus can be deepened by taking one additional step.

After the mylohyoid ridge has been excised and smoothed, the periosteum below the muscle attachments is elevated from the mandible, down to the lower

border. With the mylohyoid ridge removed, an excess of mucoperiosteal covering is available. The floor of the mouth, with its freed mylohyoid muscle stumps, is easily depressed to the level of the inferior border of the mandible.

A small pliable piece of catheter tubing about 1½ to 2 inches long is ligated into position with no. 0000 Dermalon sutures (Fig. 5, below). A large ⅜ curved needle is used for this purpose. The suture is placed in the tubing through its lumen, and both ends of the suture are then threaded into the needle. The depth to which the lingual sulcus is to be extended is estimated, and the large double threaded needle is carried through the mucosa at the desired lower level. The mylohyoid muscle stumps are identified and engaged in the needle, and the needle is then passed on beneath the lower border of the mandible and out through the skin.

To eliminate pain, local anesthetic is infiltrated into the skin through the buccal sulcus. When these two or three stay sutures have been placed, the ends are clamped and they are permitted to hang free until the oral wound has been closed.

The wound is closed with simple interrupted sutures in the usual manner, except that no part of the excess soft tissue covering is excised since it will be needed to cover the lingual surface of the bone when the floor of the mouth is sutured down (Fig. 6, left). The ends of the deep stay sutures that have been carried to the outside are tied around a cotton roll and are left in position for about one week (Fig. 5, below). Excessive tension should be avoided. If the sutures are placed about ½ inch from each end of the rubber tubing, these ends will curve upward and prevent tissue ulceration in the floor of the mouth.

■ *Summary*

Frequently, a lower denture is more readily tolerated after detachment of the

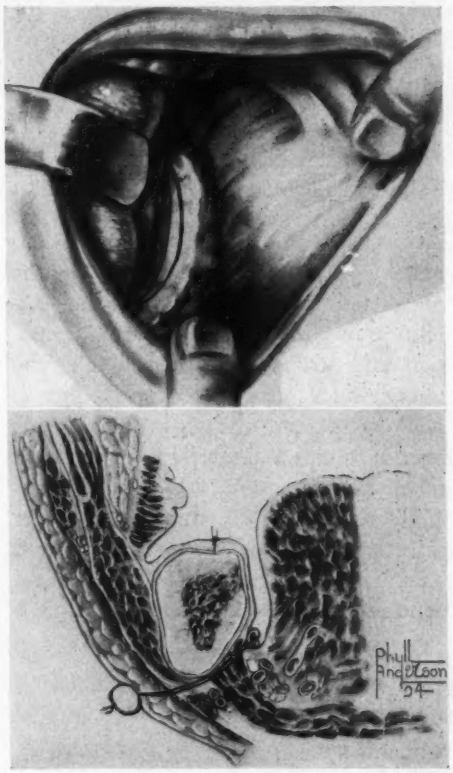

Fig. 5—Above: After simple excision of mylohyoid ridge, a narrow elipse of mucoperiosteal flap is removed to avoid excessive redundant tissue over ridge. Below: With mylohyoid ridge removed, sufficient soft tissue is available to close wound and to deepen lingual sulcus. Drawing illustrates catheter tubing sutured into depth of lingual sulcus, with sutures carried through detached mylohyoid muscle and out to skin below lower border of mandible

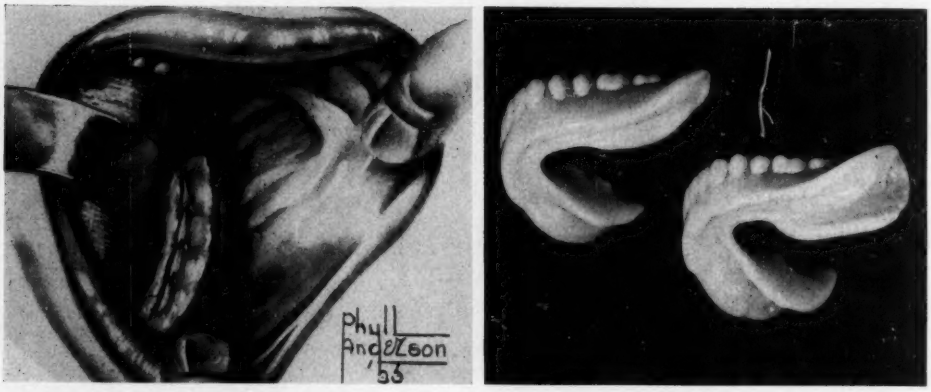

Fig. 6—Left: Intraoral closure by interrupted sutures. Right: Benefit to be derived from this method of ridge extension is illustrated by the old and new dentures shown. On the right, new denture with extended lingual periphery; old denture at left

mylohyoid muscle and excision of the mylohyoid ridge. When additional stability is needed because of alveolar resorption and atrophy of the mandible, the lingual sulcus can be deepened. This is done by suturing the severed mylohyoid muscle stumps at a lowered position with Dermalon stay sutures that are fixed intraorally to a short length of soft rubber catheter tubing and extraorally to cotton rolls. The lingual periphery of the lower denture can thus be extended considerably to afford lateral stability (Fig. 6, right).

With this technic, there is no danger of disrupting the continuity of the Wharton's duct, injuring the lingual nerve, or of causing hemorrhage from vessels in the floor of the mouth, since all of the surgery is accomplished beneath the lingual periosteum. Immediate swelling is minimal, and healing is sufficiently advanced within two or three weeks to permit the initiation of denture construction.

■ DESTINY OF SCIENCE

It is the great destiny of human science, not to ease man's labors or prolong his life, noble as those ends may be, nor to serve the ends of power, but to enable man to walk upright, without fear, in a world which he at length will understand and which is his home.—*P. B. Sears, "Charles Darwin," 1950, p. 118.*

General anesthesia for oral surgery—the anesthesiologist's viewpoint

■ *Jess Edward, M.D., Freeport, N. Y.*

More than 100 years ago the problem of pain in oral surgical cases spurred the search for analgesic drugs and technics. Over the period of years new drugs have been used and technics have been developed so that safer and physiologically better anesthesia and analgesia are possible both in the oral surgical office and in the hospital operating room.

The development of local anesthetic drugs for local infiltration and regional nerve block has been a step toward safe, effective analgesia, but there are still many patients for whom general anesthesia is indicated. Often this indication is at the insistence of the patient who wishes to be asleep and who does not fully realize the dangers inherent in even the simple administration of general anesthetic agents.

In a hospital, anesthesiology can be practiced in its purest form, with dangers minimized by adequate preoperative examination, control of eating prior to surgery and premedication prescribed for control of secretions, reflexes and for psychic sedation.

In spite of all the advantages, certain factors make hospital care impractical for most oral surgical cases. The expense of hospitalization, the shortage of hospital beds in most communities and the inconvenience in time loss to patients make hospital care unfeasible.

The majority of oral operations, therefore, are done in the oral surgeon's small operating room. There, one must face disturbing factors that are hazards to the safety of the patient. One cannot premedicate the patient in the optimum manner, nor can an adequate history be taken or a physical examination be made. Patients often have eaten prior to coming to the office, and they usually are very apprehensive. The anesthetist then is faced with an increased possibility of vomiting, aspiration, cardiac arrest or arrhythmias due to reflex changes.

In view of the hazards that can be encountered and the difficulties that an anesthetist must face during the course of the seemingly simple anesthetic procedures, one must attempt to find the safest possible methods and agents if general anesthesia is to be administered in the oral surgical office.

As an anesthesiologist I believe that safe and effective anesthesia and analgesia can be administered to the oral surgical patient in the office. Certain tenets, however, must be followed by the oral surgeon

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The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or of the Department of the Defense.

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and the anesthetist, whether a nurse, dentist or physician. One must be prepared for emergencies such as cardiac arrest, aspiration, severe laryngospasm, apnea and prolonged respiratory depression. One should be able to use a laryngoscope and to insert an endotracheal tube. One also should be well versed in the use of all anesthetic agents and have a thorough knowledge of their action and of their dangers.

The anesthetics most commonly used for oral surgery are nitrous oxide, trichloroethylene, thiopental (Pentothal) sodium, vinyl ether (Vinethene), ether and as an adjunct succinylcholine chloride and intravenous meperidine hydrochloride (Demerol).

Nitrous oxide, the oldest analgesic agent, is still the "work horse" for oral surgery. Its usefulness, however, has been increased tremendously in the past few years by the synergistic actions of various new drugs, such as the sulfurated barbiturates, trichloroethylene and intravenous meperidine hydrochloride. In my opinion, nitrous oxide should always be used with helping agents. The formerly used method of secondary saturation with 100 per cent nitrous oxide with its period of anoxia can, and should, be abandoned. Anoxia, no matter how brief the period, is physiologically dangerous. With safer technics there is no reason why the burden of anoxia should be imposed on the patient in the oral surgeon's chair.

Trichloroethylene is one of the most recent drugs whose analgesic action when used with nitrous oxide provides a satisfactory and safe method for oral surgical procedures. Induction with nitrous oxide and trichloroethylene with at least 25 per cent oxygen is pleasant and rapid and does not involve hypoxia. Exodontic and other surgical procedures can be performed easily when the patient is in a state of analgesia which apparently persists for a short time even after the agents are discontinued. Recovery is pleasant and rapid, and the patient can go home safely within a short time.

The dangers of trichloroethylene are as follows: (1) occasional cardiac arrhythmias, especially if epinephrine is used with a local agent and (2) the production of a neurotoxic degradation product, dichloracetylene, if tricholoroethylene is used in conjunction with soda lime absorbers. An absorber, of course, is rarely needed or used on the common dental gas machines.

Several articles have appeared lately in the anesthesia and dental journals concerning the side effects and dangers of trichloroethylene. In the pharmacology and physiology laboratories it has been noted that arrhythmias in the form of premature contractions, auricular and ventricular extrasystoles, often develop with the use of trichloroethylene. These arrhythmias rarely are seen in clinical analgesia but are seen on the electrocardiographic tracing in deep anesthesia. Much of this work on trichloroethylene goes back to 1943 before the drug was used clinically in large amounts. Some men advocate abandoning the drug for use in dental offices because of the potential danger of the arrhythmias. Extensive use of the drug in more than 1,000,000 cases in England, Canada and the United States, however, has shown that trichloroethylene, as it is most commonly used clinically for analgesia, is as safe as any

agent now used in modern anesthetic technics.

Any anesthetic drug, of course, is potentially dangerous, for it is a reversible toxin to the body. Modern anesthesiology attempts to make use of certain qualities of each drug in a balanced system, and in such a balanced anesthesia, trichloroethylene with its excellent analgesic properties, rapid action, easy recovery and lack of nausea has advantages that far outweigh its disadvantages, especially for office anesthetic procedures.

The sulfurated barbiturates, namely the ultra-fast-acting thiopental sodium and thiamylal (Surital) sodium, are agents that are of great value in the field of anesthesiology because of their ease of induction with little or no excitement stage, the pleasant sleep for the patient without the discomfort and fear of the face mask, and the relatively rapid recovery postoperatively.

Barbiturates are hypnotic agents and have little analgesic effect. Alone they are poor anesthetic agents, but when the ultra-short-acting barbiturates are combined with nitrous oxide with its analgesic properties, they become anesthetic agents of great importance.

One must keep in mind, however, the dangers of these drugs, which are respiratory depression with its hypoxia and respiratory acidosis, the prolonged, postoperative depression and the occasional severe laryngospasm that one may encounter. It is felt that the barbiturates accentuate the irritability of the larynx. Severe laryngospasm in which the laryngeal opening appears like a tightly closed rosebud is sometimes a very difficult condition to correct and may lead to anoxic death. Often a muscle relaxant must be used, or as a last resort intubation or tracheotomy may have to be attempted to save the patient.

Vinyl ether is an agent that is rapid in action with excellent analgesic properties. It is most commonly used for short procedures on children by the open drop method for light analgesia. It also may be used on the gas apparatus for light analgesia to supplement nitrous oxide and oxygen.

Of the newer agents, mention should be made of succinylcholine chloride. This drug is the newest muscle relaxant that has the advantage of rapid action and rapid detoxification by the pseudocholinesterase of the plasma. With succinylcholine chloride the anesthetist can keep a patient in lighter planes of anesthesia yet relax the jaw for intubation and oral surgical procedure. No longer does one have to anesthetize a patient to the lower third plane of surgical anesthesia and struggle to visualize the glottis for intubation with resulting trauma and chipped teeth. Intubation has become much easier with proper use of succinylcholine chloride, and relaxation of the mandible for oral surgical procedures can be accomplished with relative ease under light anesthesia.

The use of succinylcholine chloride, however, is fraught with danger, for the anesthetic easily can cause respiratory depression by intercostal paralysis. The anesthetist must be prepared to inflate the lungs to prevent anoxia. Occasionally the apnea is prolonged, and one must stay with the patient until respirations are spontaneous and full. This, however, is a rare occurrence. For general use in

skilled hands, succinylcholine chloride is a drug of great value in facilitating good anesthesia and oral surgery.

Meperidine hydrochloride in small doses of 20 to 100 mg. intravenously is also a supplementary agent of increasing importance when used with nitrous oxide, oxygen and thiopental sodium. It apparently obtunds the tracheal reflex when endotracheal technics are used and lessens the amount of barbiturate needed during fairly long operative procedures because of its analgesic action.

One can see that, with these varied drugs, an anesthetist has a wide range of anesthetics and technics from which to choose in order to achieve a balanced anesthesia.

In the hospital operating room the technics most commonly used for the operations lasting more than a few minutes are the nasotracheal or nasopharyngeal intubations with topical cocaine, tetracaine hydrochloride (Pontocaine) or hexylcaine (Cyclaine) spray. The anesthesia is maintained with thiopental or thiamylal sodium and nitrous oxide-oxygen with or without trichloroethylene, and occasionally intravenous meperidine hydrochloride. Trichloroethylene and to some extent intravenous meperidine hydrochloride have the distinct advantage, however, of lessening the amount of thiopental sodium needed, thus preventing the prolonged postanesthetic sleep that often occurs after the use of an intravenous barbiturate. It has been shown that the intravenous barbiturates are ultrashort-acting not because they are detoxified rapidly, but because they are removed rapidly from the plasma and then stored in the fat depots of the body. This reservoir of drug can cause a prolonged sleep and respiratory depression in either the hospitalized or the ambulatory patient. Trichloroethylene also seems to obtund the tracheal reflex, possibly by its action on the cranial nerves, so that the bucking reflex is less pronounced, hence lighter anesthesia with less barbiturate can be accomplished.

Most of the surgical procedures performed in the oral surgeon's office can be managed by vinyl ether analgesia, nitrous oxide, oxygen-trichloroethylene or thiopental sodium nitrous oxide-oxygen, without resorting to the physiologically unsound hypoxia technic which I am sure is still used in many oral surgical offices by trained personnel. Few complications are reported with these so-called short procedures, but one cannot be certain of the amount of damage to the brain cells or the conductive mechanism of the heart that may occur.

■ *Improvements Needed*

From the viewpoint of the anesthesiologist there are improvements to be achieved in the field of anesthesiology for oral surgery.

Of major importance is the training of the oral surgeon during his residency program so that he can spend a minimum of three months, and preferably a year, in the field of anesthesiology under an anesthesiologist's supervision. With his participation in the various technics of general anesthesia, the resident will learn much of the physiology and pharmacology of anesthesiology. He will become adept at endotracheal intubation and other fine points of the anesthetist's art, as well as understanding the difficulties that are en-

countered frequently during an anesthetic procedure. He would be prepared to use general anesthesia in his own oral surgical practice in a safer and more efficient manner.

I believe, too, that anesthesiologists themselves should make an effort to provide better training in the field of oral surgical anesthesia for their own residents during their two year residency training program so that there is a better understanding of the problems and principles and refinements necessary for office anesthesia in contrast to the hospital care with which they are more familiar. With interest in this field, it seems more probable that newer improved technics may be developed as a result of the work being carried on in the various teaching centers.

■ *Summary*

If indicated, general anesthesia can be properly and safely administered in the oral surgeon's office as well as in the hospital operating room. I feel strongly, however, that the anesthetist should be well trained, adequately prepared for emergencies, adept at intubation when necessary, up-to-date with the new, safer anesthetic procedures, and fully aware of the importance of the extra care and refinement in technics that are required for good anesthetic care of the oral surgical patient.—381 *Maryland Avenue.*

A new head appliance for use in patients with maxillofacial injuries

■ *William B. Irby,* D.D.S., U.S. Army, and Gordon P. Gavin, D.D.S., U.S. Naval Reserve*

The treatment of severe fractures of the facial bones frequently requires the use of extraoral traction in order to restore and maintain the original relationship of the involved structures. Any appliances used for this purpose must be designed to afford sufficient anchorage to correct and maintain the displacement, and at the same time must be versatile enough to allow for changes and adjustments during treatment. The most common anchorage used in the past has been cranial —one which utilizes the plaster headcap or one of the many other types of head appliances designed for this purpose.

These appliances have left much to be desired, as they frequently are unstable

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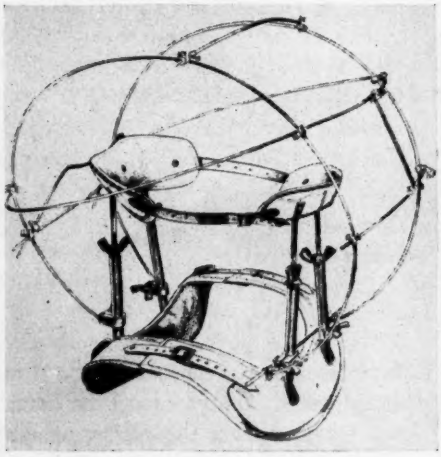
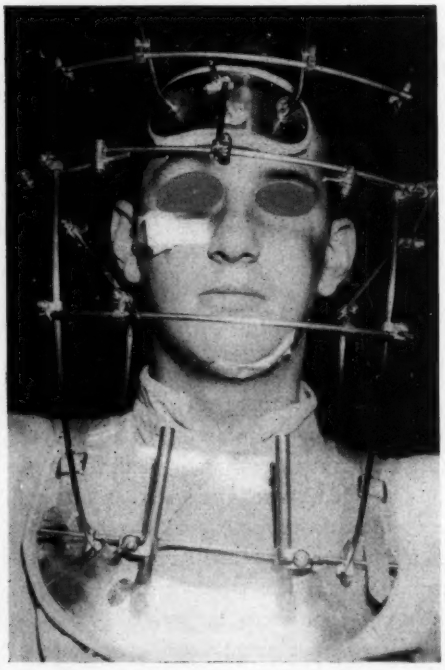
and do not lend themselves well to unilateral traction. They are uncomfortable for the patient because of the added weight and are disagreeable because of the impossibility of personal hygiene. Necrosis due to pressure spots has also been a problem.

In addition to these drawbacks, it has been found that many patients with maxillofacial injuries also have complicating head injuries; therefore, a new approach to this problem was needed.

A thorough study led to the conclusion that the anchorage should be based below the mandibular and occipital level. In order to accomplish this, a Forrester collar was selected as a basis for the traction appliance. This collar serves to maintain the head and trunk in a correct relationship, and it can be adjusted to the individual patient.

The Forrester collar was used for a base, a versatile and adjustable framework was designed (illustration, left) and was constructed of a series of spring steel wires. The framework formed a cagelike skeleton around the head when assembled. The various segments were connected by means of Roger Anderson clamps, reamed slightly to accommodate the heavier gauge wire. Four large brass clamps similar in design to the single unit Roger Anderson attachment were fitted to the four posts of the Forrester collar. These clamps attached the appliance to the base. The resulting framework was





Above: Head frame assembled on base. Right: Head frame assembled on patient. Chin cup was not used because of wound on chin

stable, completely adjustable and allowed traction to be applied from any direction. Any necessary variations or extensions could be accomplished easily by the use of additional clamps and extension arms.

In instances in which there are severe lacerations of the chin, the use of the chin cup is undesirable. The appliance may then be stabilized through use of a forehead pad, triangulated to the framework above; however, the use of the chin cup is desirable whenever possible (illustration, right).

This appliance has been used with patients and has been found to possess many advantages. Not only is it stable and adjustable, but it is more comfortable and better tolerated by the patient. In addition, it causes a minimum of interference with sleep. The face and head are easily kept clean, and it is possible to remove the appliance temporarily when bathing or shaving.

The illustration shows it as used with a patient who had depressed fractures of both zygomas and maxillae, and a comminuted fracture of the mandible which necessitated an open reduction.

Blood loss during operation for multiple extraction with alveoloplasty and other oral surgical procedures

■ *Robert J. Gores,* D.D.S.; R. Quentin Royer,† D.D.S., and Frank D. Mann,‡ M.D., Rochester, Minn.*

We observed that blood loss seemed excessive in the course of some oral surgical procedures. No data were found in the literature, however, as to the amount of blood lost during multiple dental extractions and alveoloplasty.

It is important for the surgeon to know the approximate amount of blood lost in any surgical procedure, for he must plan operative, preoperative and postoperative care for his patients.[1] Accordingly he must combat surgical shock, minimize postoperative morbidity and promote healing. One of the important

Abridgment of thesis submitted by Dr. Gores to the faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Dentistry.

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1. Coller, F. A., and Maddock, W. G. Dehydration attendant on surgical operations. J.A.M.A. 99:875 Sept. 10, 1932.

Table 1

Average blood loss in some general surgical procedures; compiled from the literature [2-4, 8-10]

About 300 cc.	300 cc. to 1,000 cc.*	More than 1,000 cc.
Herniorrhaphy	Radical dissection in neck	Operation on brain
Appendectomy	Gastric resection	Radical mastectomy
Hemorrhoidectomy	Vagotomy	Operation on thorax
Simple mastectomy	Operation on bile ducts	Abdominoperineal resection
Splenectomy	Hysterectomy	Major amputation
	Nephrectomy	

*Average of as low as 300 cc. in some of the named operations; of as high as 1,000 cc. in others. Quantities given do not indicate a range for each of the named operations.

factors involved in this is maintenance of fluid balance by replacement of blood lost at surgical operation.

Gatch and Little[2] in 1924 were the first to measure blood loss during some of the common general surgical operations. Since 1924 more than 30 authors, using various methods, have studied blood loss during a variety of surgical procedures; all had comparable results. The original study of Gatch and Little, therefore, has been confirmed and enlarged on to the point that data on blood loss now can be found covering almost every type of surgical procedure (Table 1) except, as stated before, some of the operations commonly performed by oral surgeons.[3-6]

From an extensive review of the literature on measurement of blood loss during surgical operations,[7] the following general facts emerged:

1. It is universally agreed that blood loss during surgical operation always is larger than the surgeon anticipated. This is true even with experienced surgeons.

2. The postoperative blood loss, in some instances, may be as large as, or larger than, the operative blood loss.

3. Amounts of hemoglobin, hematocrit values and determinations of plasma protein cannot be relied on to indicate the quantity of blood lost or the need for replacement of blood or fluid.

4. Patients in fairly good physical condition usually can lose from 600 to 700 cc. of blood without any apparent harmful effect on the postoperative course.[2]

5. It is agreed by many authors that a blood loss of 300 cc. or less should be replaced with fluids other than whole blood, and that a loss of more than 300 cc. should be replaced with whole blood.[8]

6. Most authors agree that a blood loss in excess of 500 cc. should be replaced with whole blood as soon as possible. By so doing, two things are accomplished: circulating blood volume is restored, and red cell volume is returned to within normal limits, thereby improving the oxygen-carrying power of the blood. Although the body has the ability to replace plasma rapidly after blood loss, it is very limited in its ability to replace

2. Gatch, W. D., and Little, W. D. Amount of blood lost during some of the more common operations. J.A.M.A. 83:1075 Oct. 4, 1924.

3. Coller, F. A.; Crook, C. E., and Iob, V. Blood loss in surgical operations. J.A.M.A. 126:1 Sept. 2, 1944.

4. Bonica, J. J., and Lyter, C. S. Measurement of blood loss during surgical operations. Am. J. Surg. 81:496 May 1951.

5. Dingman, R. O.; Ricker, O. L., and Iob, V. Blood loss in infant cleft lip and cleft palate surgery. Plast. & Reconst. Surg. 4:333 July 1949.

6. Buddington, W. T., and Taylor, G. W. Loss of blood in certain standard operations for malignant disease. New England J. Med. 218:285 Feb. 17, 1938.

7. Gores, R. J. Determination of blood loss associated with selected oral surgical procedures. Thesis, Graduate School, University of Minnesota, 1955.

8. Wangensteen, O. H. Controlled administration of fluid to surgical patients including description of gravimetric methods of determining status of hydration and blood loss during operation. Minnesota Med. 25:783 Oct. 1942.

lost red cells. Red cell volume does not return to normal limits for several weeks after uncompensated blood loss.[9]

7. All authors agree that knowledge of quantity of blood lost by the aged, undernourished and other poor-risk patients, especially those suffering from cardiovascular disease, is of great value. For these patients, overreplacement of blood may be as serious as underreplacement, because many of these patients cannot tolerate even small changes in volume of circulating blood.

8. Only a gross correlation exists between the amount of blood lost and the clinical signs of shock. Those who have studied blood loss feel that other factors exert powerful influences on the development of shock. They list such factors as cooling of the patient, length of operative procedure, skill of the surgeon, character of the anesthesia, rapidity of the blood loss, and manipulation of the viscera.

9. A definite relationship exists between body weight, quantity of blood lost, total blood volume and development of shock. Patients who lose more than 20 per cent of the total volume of their blood frequently exhibit clinical evidence of shock.[10,11]

■ *Method and Procedure*

In the present study, the blood lost by 50 patients who underwent oral surgical operations was measured. The patients were taken in the order in which they presented themselves. They ranged in age from 17 to 73 years; 32 were men and 18 were women. In each instance all surgical work was completed in one operative period.

All patients were evaluated by a member of the Section of Medicine, Mayo Clinic, and were considered as good surgical risks. There appeared to be no contraindications to use of a general anesthetic or to elective surgery. All patients were admitted to the hospital on the day of operation, and the concentration of hemoglobin was estimated just before operation.

In 47 patients, the operations consisted of removal of many teeth and of alveoloplasty of an extent necessary to prepare properly the alveolar ridges for dentures. In almost all of these patients, the operation included, also, one or more of the following: surgical removal of one or more impacted or imbedded third molars, surgical removal of imbedded maxillary cuspids, superior frenectomy, removal of maxillary or mandibular tori, surgical removal of retained roots or removal of dentigerous or radicular cysts. In some instances, this additional work lengthened the operating time. The shortest operating time was ten minutes, and the longest, 85 minutes; the average time was 37 minutes.

The nature of the operations performed on the three remaining patients is described in some detail under the heading "Results."

At the beginning of this study, the impression was that the following factors had the greatest influence on blood loss

9. Lyon, R. P., and others. Blood and "available fluid" (thiocyanate) volume studies in surgical patients; normal patterns of response of the blood volume, available fluid, protein, chloride, and hematocrit in postoperative surgical patient. Surg., Gynec. & Obst. 89:9 July 1949.

10. Nadal, J. W. Blood loss in orthopedic operations. Univ. Hosp. Bull., Ann Arbor 5:74 Oct. 1939.

11. Elman, Robert. Surgical care: a practical physiologic guide. New York, Appleton-Century-Crofts, Inc., 1951, p. 242-243.

Table 2
Blood loss during multiple extraction and alveoloplasty

Alveoloplasty, grade	Cases	Local anes. and vaso-constrictor	Op. time, average minutes	Blood loss, cc.		
				Min.	Max.	Average
1 and 2	13	No	34	61	280	179
	9	Yes	27	5	166	109
3 and 4	13	No	45	191	771	401
	12	Yes	45	72	401	201

from surgical procedures performed in the oral cavity:

1. Length of soft tissue incision.
2. Extent of mucoperiosteal flaps.
3. Amount of alveolar bone cut.
4. Operating time.

With these impressions in mind, extent and severity of alveoloplasty were graded as follows:

Grade 1. Removal of teeth. No cutting of alveolar bone. No alveolar mucoperiosteal flaps.

Grade 2. Removal of teeth. Removal of interproximal bone from alveolar crests, without extensive mucoperiosteal flaps.

Grade 3. Removal of teeth. Moderate removal of alveolar bone from crests and from buccal or labial aspects (either or both) with extensive mucoperiosteal flaps.

Grade 4. Removal of teeth. Extensive removal of alveolar bone from crests and from buccal or labial aspects (either or both) with extensive mucoperiosteal flaps.

According to the afore-mentioned criteria, the operations performed on each patient were graded at the end of the procedure by the surgeon and his first assistant.

The operations were performed by six surgeons and general anesthesia was employed in all instances. Anesthesia was obtained with thiopental sodium, 2.5 per cent, (given intravenously), and in the majority of instances the anesthesia thus brought about was augmented with nitrous oxide and oxygen. After 21 of the 47 patients had reached the first plane of surgical anesthesia, the tissues were infiltrated with 3 per cent piperocaine hydrochloride containing epinephrine in a dilution of 1:56,000. Five cubic centimeters of the solution was injected through the buccal or labial sulci, in the operative region of each dental arch. After the injections, the operation was begun at once. None of the patients complained of postoperative pain, discomfort or a feeling of numbness at the sites of injection. Twenty-six patients were operated on without the use of local anesthetic and vasoconstricting drugs and were considered as a control group (Table 2).

The blood lost during operation was collected on sponges and by aspirator. Gauze throat packs were placed in the oropharynx to prevent escape of blood into the esophagus or trachea. After operation, the instruments and gloves were wiped free of blood with wet sponges. The contents of the aspirator bottle and all used sponges were saved in separate containers. The sponges were covered with water as soon as they had been placed in the

container. The containers were then removed to the laboratory so that the quantity of blood they contained could be estimated.

■ *Laboratory Method*

The method employed in this study was essentially the same as that described by Pilcher and Sheard[12] in their study on blood lost during transurethral prostatic resection. The method is based on determination of the quantity of hemoglobin lost and eliminates many of the subjective errors that attend the use of other methods. The present method differs from that of Pilcher and Sheard only in that for determination of hemoglobin they caused oxyhemoglobin to be formed, whereas in the present study, the compound caused to be formed was cyanmethemoglobin, the most stable of the hemoglobin pigments.[13-15]

By means of a photoelectric colorimeter (Sheard-Sanford photelometer)[16,17] direct determinations of hemoglobin were made on the aspirated blood lost at surgery. Serial washings of the sponges, with the aid of a Kahn shaker, were required to remove all of the hemoglobin. Usually, three successive washings of the sponges were necessary. Determinations of hemoglobin were made on each of the washings.

Hemoglobin determinations were performed on the venous blood of each patient prior to surgery. When the volumes of the various washings, the concentration of hemoglobin therein, and the hemoglobin value in grams per 100 cc. of the patient's blood were known, the amount of blood lost during operation could be determined by the following formula:

$$\frac{\text{Total Hb in Gm. in lost blood}}{\text{Hb. per 100 cc. of pt's. preop. blood}} \times 100 = \text{cc. blood lost}$$

Pilcher and Sheard confirmed the accuracy of their method by spilling a known amount of blood on a pile of sponges and linen. They found that about 3 per cent of the blood was not recovered. In the present study, the accuracy of the method was confirmed in the same manner and the same conclusion was reached.

■ *Results*

The instances in which alveoloplasty, grades 1 and 2, was performed are presented together; in most of these the operation was of grade 2. Alveoloplasty, grades 3 and 4, also are presented together; in most of these, the operation was of grade 3.

The largest quantity of blood lost by any patient was 771 cc. (illustration). One patient lost 600 cc. of blood, but in the remainder of the patients, the loss was less than 500 cc.

Of the subgroups of the group of 47 patients, the greatest loss of blood occurred in that one in which alveoloplasty was of grades 3 and 4 and in which a vasoconstrictor was not used. In eight of the patients of this subgroup, losses

12. Pilcher, Frederick, Jr., and Sheard, Charles. Measurements on loss of blood during transurethral prostatic resection and other surgical procedures, determined by spectrophotometric and photelometric methods. Proc. Staff Meet., Mayo Clin. 12:209 April 7, 1937.

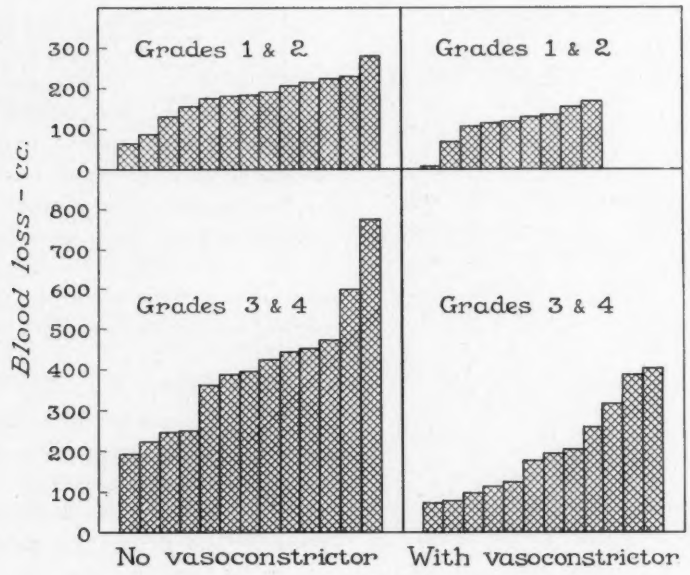
13. Mann, F. D. Clinical determination of hemoglobin. Minnesota Med. 36:255 March 1953.

14. Sunderman, F. W. Note on use of permanent standard for hemoglobin measurements. Am. J. Clin. Path. Tech. Supp. 7:1 Jan. 1943.

15. Turner, Arthur. Micro method for determination of hemoglobin. Bull. U. S. Army M. Dept. 5:605 May 1946.

16. Sheard, Charles, and Sanford, A. H. The photelometer. Proc. Staff. Meet., Mayo Clin. 8:516 Aug. 23, 1933.

17. Todd, J. C., and Sanford, A. H. Clinical diagnosis by laboratory methods; a working manual of clinical pathology, ed. 10. Philadelphia, W. B. Saunders Co., 1944, p. 215-216.



Blood loss during operations for multiple extraction with alveoloplasty; 47 patients

were about 400 cc. or more, whereas in the comparable subgroup (alveoloplasty, grades 3 and 4; with vasoconstrictor) the loss was about 400 cc. in only two instances.

Comparison of the subgroups in which alveoloplasty, grades 1 and 2, was done indicates that blood loss was greatly reduced through use of a vasoconstrictor. The greatest loss when a vasoconstrictor was used was 166 cc., whereas in nine patients in whom a vasoconstrictor was not used the loss was more than this.

The following observations are indicated by the data in Table 2:

1. Use of vasoconstrictors apparently did not reduce the average operating time; however, surgeons remarked that freedom from hemorrhage improved working conditions.

2. Minimal, maximal and average blood loss was greatly reduced in all patients if a vasoconstrictor was used.

Four patients had hypertension. Our impression was that these patients bled more than others; however, none lost more than 400 cc. of blood.

Thus far, this report has had to do with 47 of the 50 patients. The remaining three were set aside at the outset of the discussion because in these the operation was extensive. These operations were as follows:

1. Bilateral, maxillary, dentigerous cysts, extending high into both maxillary

sinuses, were removed from a woman, 20 years of age, who weighed 86 pounds (39 kg.). The operative procedure required 90 minutes and 1,139 cc. of blood was lost. Blood and other fluids were given intravenously. Recovery and healing were uneventful, and the patient left the hospital on the third postoperative day.

2. A girl, seven years old, who weighed 54 pounds (24.5 kg.), underwent operation for diffuse mandibular fibrous dysplasia. Extensive curettage of fibrous tissue began on the left side of the mandible and was carried across the midline to the cuspid region of the right side. Blood lost measured 298 cc., and the operating time was 65 minutes. Fluids were given intravenously, both during and after operation. The girl left the hospital on the fourth postoperative day. Healing proceeded without complication.

3. Bilaterally impacted teeth were removed from the maxilla of a woman, 54 years old, who weighed 162 pounds (73.5 kg.). On one side the imbedded tooth extended into the nasal cavity; on the other side, into the maxillary sinus. The operating time was 70 minutes. The blood lost measured 577 cc. Fluids were given intravenously. Healing proceeded without complication.

■ *Comment*

A few matters either recorded in, or suggested by, the foregoing report need to be emphasized. Although many of the patients were given fluids intravenously during and after operation, none of those who were subjected to multiple extraction and alveoloplasty received transfusions of whole blood and in no instance was delayed hemorrhage noted. Forty-six of the 50 patients left the hospital on the morning after operation. Healing was uncomplicated and apparently was not affected by the use or nonuse of a vasoconstrictor solution. Use of a local anesthetic solution with which epinephrine is mixed, in addition to having value as a vasoconstrictor, enables the anesthetist to carry the patient on a surgical plane of anesthesia with minimal use of general anesthetic agents, thus promoting the safety of the patient during operation and minimizing the possibility of postoperative complications of anesthesia. Through use of vasoconstricting drugs in conjunction with a general anesthetic agent, blood loss can be reduced by as much as 50 per cent in the average patient.

It has been shown that loss of dangerously high quantities of blood can and does occur during major oral surgical operations. Even though the loss of blood seldom exceeds 500 cc., the oral surgeon should be mindful of the possibility of excessive loss in the course of extensive operative procedures and should be prepared to treat patients for it.

■ *Summary*

Blood loss was measured in 50 patients in whom oral surgical procedures were performed. In 47 patients, the operation was multiple extraction and alveoloplasty; in three, it was more extensive. The magnitude of the blood loss approximated that of general surgical procedures such as gastric resection.

All patients received general anesthesia. In 21 of these patients, the soft tissues in the region of the operation were infiltrated with a local anesthetic solution

which contained a vasoconstrictor drug. The 26 patients who did not receive the local anesthetic were considered as controls. When operations of equal severity were compared, it was found that use of the vasoconstrictor decidedly diminished blood loss. The corresponding increase in dryness of the operating field, however, did not reduce average operating time.

Treatment of nonunion of mandibular fractures by intraoral insertion of homogenous bone chips

■ *Robert B. Shira,* D.D.S., Washington, D. C., and Ogden M. Frank,† D.D.S., Phoenixville, Pa.*

Nonunion is one of the annoying complications encountered in the treatment of mandibular fractures. This complication may be brought about by inadequate reduction, inadequate immobilization, an insufficient period of immobilization, loss of osseous substance due to trauma or disease, infection, systemic disorders and various other causes. Regardless of the cause, however, most instances of nonunion are accompanied by varying amounts of resorption of the fragments with eburnation of the bone ends and interposition of fibrous tissue. These conditions bring about a loss of osseous structure and prevent bone regeneration.

Correction of the nonunion requires surgical exposure of the region to permit removal of the interposed fibrous tissue as well as the removal of sufficient bone from the ends of the fragments to obtain fresh bleeding surfaces. Continuity of the bone must then be re-established, and this re-establishment must be followed by complete immobilization for a period long enough to allow for bone regeneration.

In re-establishing continuity of the bone, two procedures are available. Direct approximation and wiring of the fragments after their surgical preparation can be employed when the loss of osseous substance has been minimal. This procedure is particularly applicable when the nonunion develops distal to the tooth-bearing regions, or where the loss of sub-

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stance has been so small that the slight collapse of the arch necessary to obtain bone contact will not result in disruption of occlusion. If the nonunion is accompanied by moderate to extensive loss of substance, or if it occurs within the tooth-bearing regions, however, direct approximation results in collapse of the arch with disruption of occlusion and function. When these latter conditions are present, some type of bone graft is necessary to maintain the fragments in their correct position.

When referring to bone grafts, the terms "autogenous" and "homogenous" are used frequently and their meanings should be clear. Autogenous means "self-generated," and when used to identify a graft implies that the graft was taken from the patient's own body. Homogenous means "same kind," and when used to denote a graft, refers to the graft being taken from a member of the same species. Most autogenous grafts are used in a fresh state, although on occasion they may be frozen and stored for future use. Homogenous grafts are seldom used in a fresh state and are usually stored in a bone bank until needed for some grafting procedure.

Although many types of grafts have been utilized in the treatment of mandibular nonunions (free autogenous rib, autogenous iliac bone chips, sliding mandibular pedicle, homogenous freeze dried bone and so forth), the one most frequently employed is the free autogenous iliac graft. In this procedure a solid section of bone is secured from the ilium and transferred to the site of the nonunion.

Although the advantages of the iliac graft are well known and its use is a recognized standard procedure, there are certain disadvantages associated with its use in the treatment of mandibular nonunion. The obtaining of the graft is relatively simple, but it does require hospitalization, additional surgical personnel and a completely aseptic technic. Securing the bone from the donor site usually causes the patient considerable postoperative pain, discomfort and some degree of temporary disability. One of the basic requirements for the use of this graft is complete freedom from infection at the recipient site, and since many instances of mandibular nonunion are associated with infection, treatment is often necessarily delayed. Some surgeons[1] insist that the region be free of infection for one year, whereas others[2] feel that a two month period is sufficient. Application of the graft requires an extraoral approach in order to maintain complete sterility, and the graft is placed in jeopardy if the wound is compounded into the mouth. After insertion, prolonged immobilization is essential to insure bone union. Twelve weeks is the average period recommended.[3] Occasionally infection, hematoma formation and delayed healing at the donor site are additional complicating factors.

Many of these disadvantages have been obviated by a technic in which homogenous bank bone chips are inserted into the site of nonunion through an intraoral approach. First, the necessity of

1. Crouch, T. H. Use of anterior iliac crest as a source of bone graft. U. S. Armed Forces M. J. 1:1431 Dec. 1950.
2. Blackstone, C. H. Freeze-dried bank bone and its application in clinical oral surgery. Mil. Surgeon 114:437 June 1954.
3. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1587.

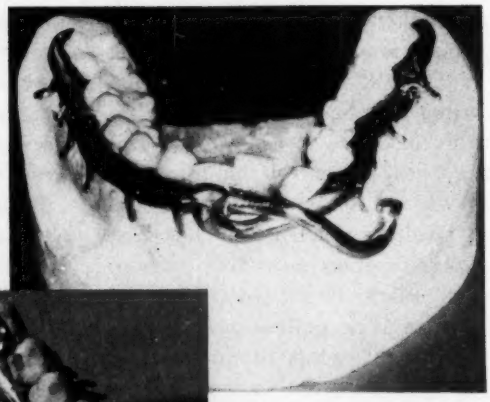
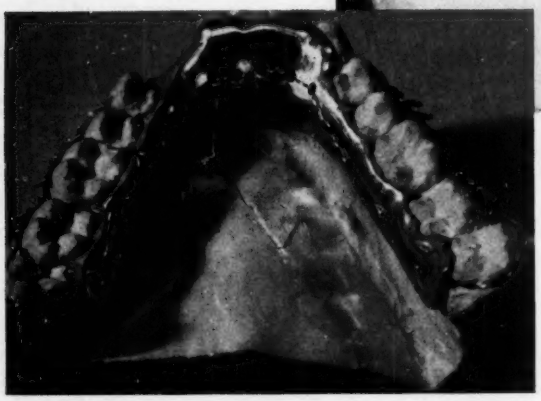


Fig. 1—Below: Cast lingual splint constructed on reassembled mandibular model after sectioning through site of nonunion



Above: Labial expansion splint used to separate fragments. Elastic traction between extension arms causes distracting force on fragments

a surgical procedure on the hip is eliminated since the bone is secured directly from a bone bank. Second, since this technic can be employed in the presence of infection, the period of treatment is materially shortened. Third, because of the intraoral approach, treatment can be given in the office, if desired, rather than in a hospital with additional operating room personnel. Fourth, the period of immobilization is greatly reduced, and the patient is able to function normally at a much earlier date.

■ *Technic*

In this relatively simple procedure impressions of the maxillary and mandibular arches are secured and stone casts prepared. The mandibular cast is sectioned through the fracture line and reassembled against the maxillary cast with the teeth in correct occlusion. A substantial cast silver or gold lingual splint is constructed from the corrected mandibular cast (Fig. 1, below). Care should be taken not to extend the splint onto the occlusal surfaces where it would interfere with restoration of normal occlusion. Some method of intermaxillary fixation is provided, generally intramaxillary multiple loop wiring, Ivy loops, or maxillary and mandibular labial arch bars. The mandibular fragments are then separated sufficiently to allow the insertion of the lingual splint, which is securely wired to each tooth. In some instances there is

sufficient mobility of the fragments to allow insertion of the splint by manual manipulation, in others it is necessary to use some kind of expansion splint (Fig. 1, above) to separate the fragments sufficiently for insertion of the lingual splint. Wiring of the splint to the teeth stabilizes the fragments in the desired position and corrects any collapse of the arch that may have occurred.

A suitable piece of bone is secured from the bone bank and removed from its container, under sterile conditions, and allowed to thaw. With the patient under local or general anesthesia, a generous mucoperiosteal flap is prepared on the labial or buccal surface in the region of nonunion and is reflected from the crest of the alveolar ridge to the inferior border of the mandible. The osseous defect is cleansed of all debris and fibrous tissue by sharp and blunt dissection (Fig. 2, left). Care should be taken to remove all devitalized and necrotic bone. The ends of the exposed fragments are freshened by means of chisels, burs, or rongeur forceps until good bleeding surfaces are encountered.

The bone obtained from the bone bank is then prepared with rongeur forceps and chisels into small chips approximately 2 by 3 mm. in size, using only the cancellous portion. The chips are packed lightly into the defect created by the surgical procedure and completely fill it from the inferior border to within

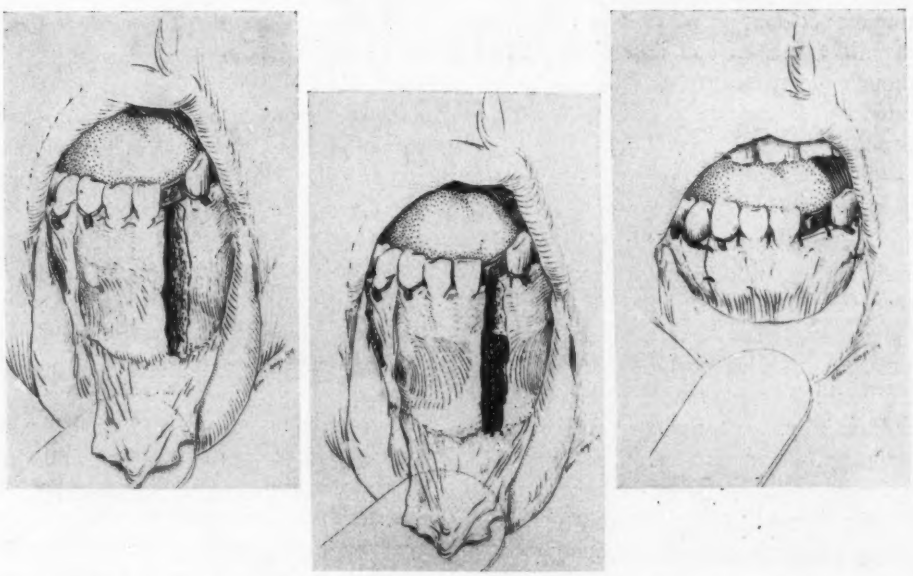


Fig. 2—Left: Bone defect after débridement and preparation of fragments. Lingual splint maintains fragments in correct position. Center: Homogenous bone chips packed into defect. Right: Mucoperiosteal flap returned and sutured in place. Intermaxillary fixation should be added for complete immobilization of fragments

0.5 cm. of the crest of the ridge (Fig. 2, center). The mucoperiosteal flap is then returned to its proper position and sutured by interrupted sutures (Fig. 2, right). The mandibular teeth are firmly immobilized to the maxillary teeth by intermaxillary wiring or elastic traction between the previously applied fixation appliances. This immobilization, aided by the lingual mandibular splint, affords firm and positive fixation of the fragments. An external pressure dressing is applied and the patient placed on adequate antibiotic therapy for ten days.

The mucoperiosteal flap usually heals by first intention. The immobilization appliances are retained for six weeks, which, with this procedure, is sufficient time to allow bony consolidation of the fragments. Clinical evidence of bone union is evident on removal of the intermaxillary fixation and lingual splint, although roentgenographic evidence of obliteration of the defect requires a longer period.

■ *Report of Cases*

Six patients with nonunion of the mandible resulting from trauma have been treated successfully by this method. Homogenous iliac bone was used in five instances and homogenous rib bone in the sixth. Three patients had extensive chronic infection in the fracture site with drainage from both the oral and facial surfaces of the mandible. The drainage stopped immediately on débridement of the wound, and the infectious process had no deleterious effect on the graft. All the defects occurred within the tooth-bearing regions of the mandible and varied in size from 0.5 to 2.5 cm. In four patients the soft tissue flap healed by first intention. In the others, the flap separated at the crest of the ridge at the end of one week, leaving some of the bone chips exposed in the oral cavity. Even though these chips were exposed, they did not become necrotic, and eventually they were covered by soft tissue as the wounds healed by granulation. Healing in all patients was complete in six weeks with restoration of normal function and occlusion.

CASE 1—A 20 year old soldier was admitted to Letterman Army Hospital, San Francisco, on January 21, 1953, for treatment of nonunion of a fracture of the mandible. He had been injured in action in Korea on November 3, 1952, but severe concomitant head injuries had delayed treatment of the mandibular fracture until November 25. Because of the seriousness of his general condition, intermaxillary fixation had been felt to be contraindicated, and a lingual mandibular acrylic splint, with circumferential wiring, had been utilized to support the fragments (Fig. 3, left). His general condition had improved gradually, and he had been evacuated to the United States with the mandibular splint in place.

Examination on arrival revealed a fracture of the mandible through the left cuspid region. There was abnormal mobility of the fragments, and in spite of the acrylic splint, moderate collapse of the arch had occurred. Drainage of a purulent exudate from an extraoral fistula, as well as from the oral surface, was evident (Fig. 3, above right). Cultures of this exudate revealed the predominating organisms to be beta hemolytic

streptococci and *Micrococcus pyogenes* var. *aureus* which were resistant to penicillin, chlortetracycline and oxytetracycline but sensitive to chloramphenicol and bacitracin. Roentgenograms showed a complete fracture of the left side of the body of the mandible with moderate loss of osseous substance. Several small sequestra could be visualized in the region (Fig. 3, left and below right).

The acrylic splint and circumferential wires were removed, and casts of the maxillary and mandibular teeth were made. The mandibular cast was sectioned, reassembled with the teeth in correct occlusion, and a cast lingual splint constructed from this corrected cast. On February 2, 1953, with the patient under local anesthesia, the nonunion was treated by the intraoral insertion of a homogenous iliac bone chip graft as described earlier in the article (Fig. 4, left).

The patient made an uneventful recovery. There was no further drainage, and healing occurred by first intention (Fig. 4, center). On removal of the im-

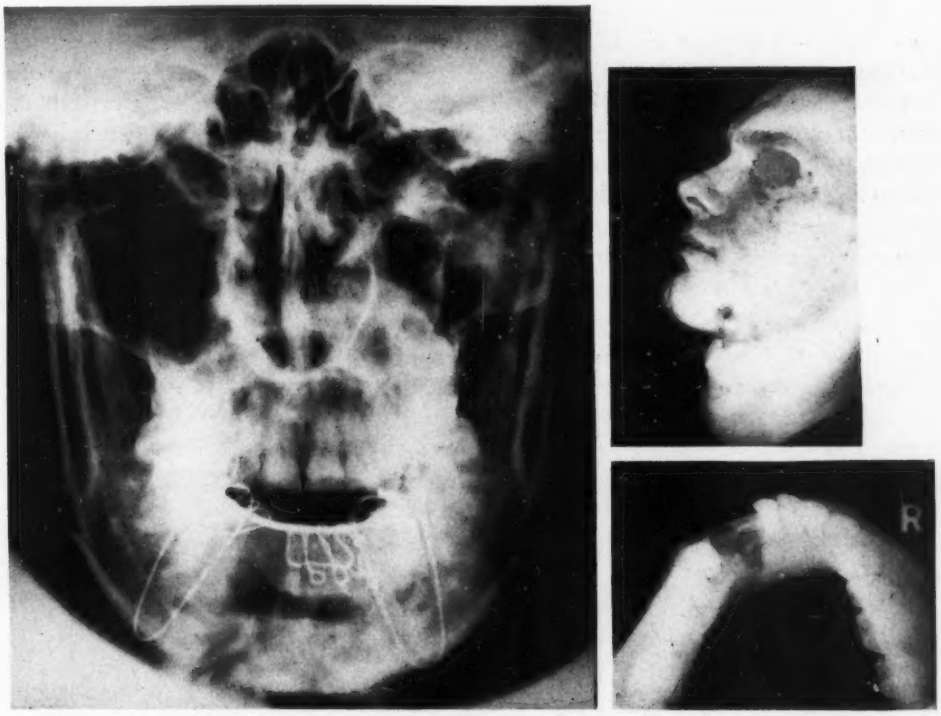


Fig. 3—Case 1. Left: Mandibular acrylic splint and circumferential wiring in place at time patient was admitted to hospital. Note osseous defect in left side of body. Moderate collapse of arch has occurred. Above right: Patient at time of admission. Note extraoral fistula. Below right: Osseous defect prior to surgery. Note small sequestra in defect

mobilizing appliances on March 18, firm union of the fragments was evident (Fig. 4, right).

Because this procedure was utilized, the patient was saved a long period of hospitalization. A free autogenous iliac graft would have required an operation to clear up the infectious process and a waiting period of from two months to a year before placing the graft. The use of homogenous iliac bone chips in the presence of infection resulted in complete bone regeneration with restoration of function, and obviated the necessity of further surgical intervention.

CASE 2—A 23 year old soldier was admitted to Letterman Army Hospital, San Francisco, on March 14, 1954, for treatment of nonunion of a fracture of the mandible. He had been involved in an automobile accident six months earlier and had been treated at another installation with the use of intermaxillary wiring. At that time the mandible was immobilized for eight weeks, and after mobilization, nonunion was evident. Roentgenograms had revealed a distraction of the fragments, and a wire had been placed across the fracture site to collapse the fragments in an attempt to obtain bone contact. A further period of immobilization in this position had been employed, but when union did not occur, the patient was transferred for further treatment.

Examination revealed nonunion of a fracture of the symphysis. The left central and lateral incisors were missing, and the fragments had been collapsed until the right central incisor was approximating the left cuspid. The mandibular teeth on the right side were in complete linguoversion to the maxillary teeth as the result of this collapse (Fig. 5, below). On manipulation, there was some mobility of the fragments, but sufficient fibrous union had taken place to prevent manual return of the fragments to their correct

Fig. 4—Case 1. Left: Lingual splint in place and homogenous bone chips inserted. Additional immobilization of fragments was secured by intermaxillary wiring. Center: Patient after débridement and insertion of homogenous bone chips. All drainage had stopped and fistula had closed spontaneously. Right: Complete regeneration of bone and re-establishment of continuity of mandible

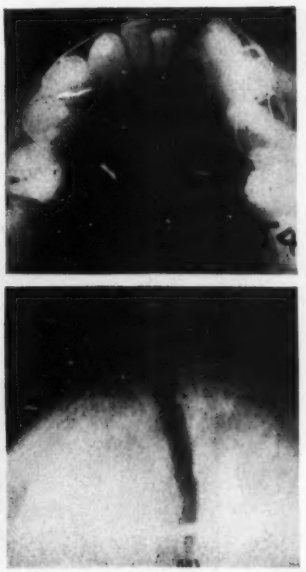
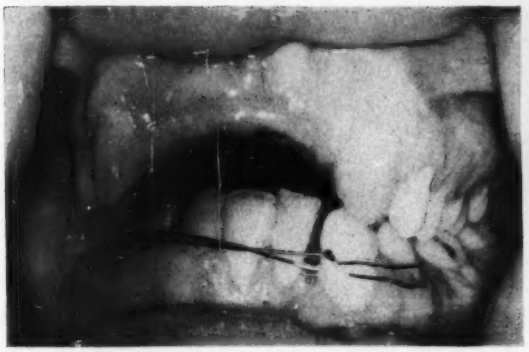


Fig. 5—Case 2. Below: Collapse of fragments with resultant malocclusion resulting from attempt to obtain bone contact after development of nonunion. Right: Collapse of fragments resulting from nonunion. Below right: Defect in symphysis resulting from separation of fragments to their correct position



position. Roentgenograms showed eburnation of the bone ends and an approximately 1 cm. space between the fragments (Fig. 5, right and below right).

Casts were prepared and the mandibular cast duplicated. On one, a labial expansion splint was constructed to be used in distracting the fragments (Fig. 1, above). The other was sectioned through the fracture site, reassembled with the teeth in their correct occlusion, and a cast lingual splint constructed. On March 19, the labial distraction splint was wired to the teeth, and strong elastic traction was applied to the extension arms. In three days there was sufficient separation to allow insertion of the lingual splint. The labial expansion splint was removed, and the lingual splint and mandibular and maxillary labial arch bars (to be used for intermaxillary fixation) were securely wired to the teeth (Fig. 6, left). With the patient under local anesthesia, the nonunion was treated by the use of a homogenous iliac bone chip graft as described earlier (Fig. 6, below left and right).

The oral wound healed by first intention, and the patient made an uneventful recovery (Fig. 7, left). The immobilization appliances were removed at the end of six weeks, and firm bone union was found to have taken place (Fig. 7, right). The collapse of the arch had been corrected with restoration of normal occlusion. On June 5, after the construction of partial dentures, the patient was returned to duty with complete restoration of function (Fig. 8).

■ *Comment*

The use of iliac bone chips in the treatment of nonunion of fractures of the mandible is not a new procedure. It has

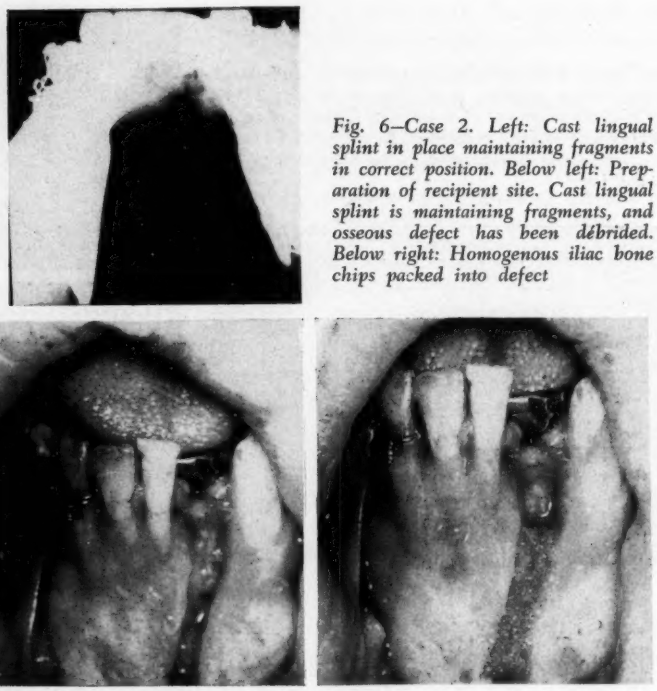


Fig. 6—Case 2. Left: Cast lingual splint in place maintaining fragments in correct position. Below left: Preparation of recipient site. Cast lingual splint is maintaining fragments, and osseous defect has been débrided. Below right: Homogenous iliac bone chips packed into defect

been used by Mowlem,[4] Gordon[5] and others. Blocker and Weiss[6] used solid sections of iliac bone, completely denuded of cortex, for the same purpose. These surgeons, however, used autogenous bone and applied it to the recipient site through an extraoral approach. Converse[7] used the intraoral approach for application of grafts to restore facial contour. He preferred autogenous bone but used homogenous grafts successfully in two instances. None of these authors, however, suggested the intraoral approach or the use of homogenous bone in the treatment of nonunions of fractures of the mandible.

The fate of all bone grafts, and the manner in which healing takes place, is controversial. Peer and Walker[8] and Marrangoni[9] stated that free autogenous grafts can maintain their vitality if early revascularization is obtained. Others, including Gordon[5] and Hyatt and coworkers,[10] expressed the belief that autogenous bone does not survive in a viable

4. Mowlem, R. Cancellous chip bone graft; report on 75 cases. Lancet 2:746 Dec. 9, 1944.

5. Gordon, S. Role of cancellous bone in plastic surgery. Surgery 20:202 Aug. 1946.

6. Blocker, T. G., Jr., and Weiss, L. R. Use of cancellous bone in repair of defects about the jaws. Ann. Surg. 123:622 April 1946.

7. Converse, J. M. Restoration of facial contour by bone grafts introduced through oral cavity. Plast. & Reconstruct. Surg. 5:295 Oct. 1950.

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9. Marrangoni, A. G. Fate of frozen homogenous bone transplants. Am. J. Surg. 82:378 Sept. 1951.

10. Hyatt, G. W., and others. New methods for preserving bone, skin and blood vessels. Postgrad. Med. 12:239 Sept. 1952.

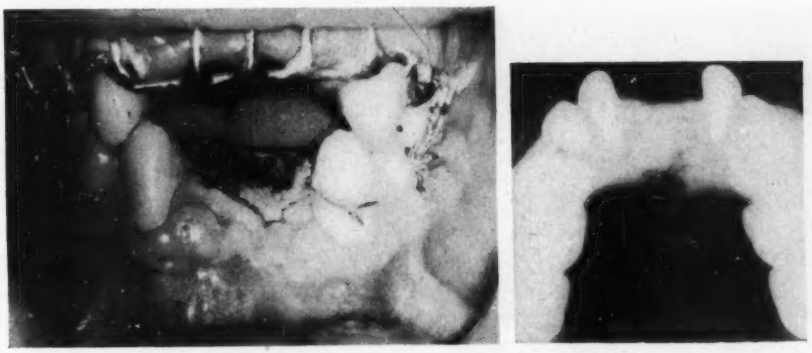

Fig. 7—Case 2. Left: View one week postoperatively. Oral wound has healed by first intention. Fragments are immobilized by lingual splint and intermaxillary wiring. Right: Firm bone union with re-establishment of continuity of mandible

state after healing but is replaced by new bone formed by the host. Most authorities, [2,11] however, agree that bank bone does not retain its vitality and hence does not produce bone, but, rather, forms a matrix or scaffolding for the creeping replacement of new bone formed by the host.[11,12]

Whether the graft remains vital or is eventually replaced by host bone is of little clinical significance as long as it supplies the stimuli for the osteogenesis that leads to bone healing. Blocker and Weiss[6] have pointed out that healing after grafting is essentially the same as healing after fracture. Formation and organization of the clot are followed by invasion of the graft by organizing vascular connective tissue. The rate of this invasion is in reverse proportion to the density of the graft, hence cancellous grafts are revascularized at a more rapid rate than cortical grafts. After revascularization, a certain amount of bone resorption, followed by redeposition of calcium and firm bony union, takes place.

The procedure reported here is suggested as a simple means of obtaining excellent results in dealing with properly selected cases of mandibular nonunion. By the use of homogenous bank bone chips, the operation necessary to secure an autogenous graft is eliminated and the exacting extraoral procedure is replaced by a relatively simple intraoral operation. Practically every large hospital has a bone bank with a supply of bone from rib resections, osteotomies, or excess bone from other grafting procedures. This bone, properly preserved, can be stored indefinitely.

It must be stressed that this intraoral procedure should be reserved for those instances of nonunion in which the defect is relatively small and is confined to the body of the mandible within tooth-bearing regions. Adequate immobilization of the fragments must be assured and

11. Hult, L. Some experiences with a bone bank. Acta Orthop. Scandinav. 19:476, 1950.

12. Phemister, D. B. Fate of transplanted bone and regenerative powers of its various constituents. Surg., Gynec. & Obst. 19:303 Sept. 1914.

Fig 8—Case 2. Restorations in place after healing of graft

approach to the site of nonunion through an intraoral approach must be feasible. The intraoral insertion of homogenous bone chips is not meant to replace the free autogenous graft for large defects where gross displacement of the fragments is present or where adequate access cannot be obtained by an intraoral approach.

At least two of the basic requirements for successful grafting, as set forth by Thoma,[13] are violated in that the operation need not be performed under strict aseptic conditions nor does the recipient site have to be free of infection. The resistance of bone chips to infectious processes is indeed remarkable and has been noted by other clinicians.[4-6, 14] Their survival, in the face of contamination and infection or simply infection, is probably dependent on the following factors: (1) complete débridement of the wound with removal of all devitalized and necrotic material, (2) adequate blood supply to insure rapid revascularization of the graft and (3) adequate antibiotic therapy.

■ *Summary*

Two of the six cases of mandibular nonunion, treated by the use of homogenous bank bone chips applied through an intraoral approach, have been reported. The experience with these patients at Letterman Army Hospital indicates that this is a simple and highly satisfactory method of treating this annoying complication of mandibular fractures. The procedure is not applicable in all instances, but, when indicated, insures excellent results with a minimum of discomfort and inconvenience for the patient.

13. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1579.

14. Bertelsen, A., and Hasnér, E. On transplantation of cancellous bone from the iliac crest. Acta Orthop. Scandinav. 19:481, 1950.

■ GRANDEUR

Grandeur consists in form, and not in size; and to the eye of the philosopher, the curve drawn on a paper two inches long is just as magnificent, just as symbolic of divine mysteries and melodies, as when embodied in the span of some cathedral roof. *Charles Kingsley.*

Ameloblastic fibroma

■ *William G. Shafer, D.D.S., M.S., Indianapolis*

The ameloblastoma is a common odontogenic tumor and many reports of its occurrence can be found in the literature. Occasional variants occur, however, which are relatively rare and, because of their unique pattern, a question frequently arises as to the manner of treatment and the prognosis of these forms.

One of the more uncommon varieties of the ameloblastoma is that lesion which has been described under numerous terms including "ameloblastic fibroma," "soft mixed odontogenic tumor," "soft mixed odontoma" and "fibroadamantoblastoma." This tumor is usually characterized by simultaneous proliferation of both primitive epithelial and mesenchymal tissue without the formation of calcified structures.

A cursory review of the literature has revealed a number of reports of tumors that may be placed in this category,[1-6] although in some instances the description is not adequate for positive classification.

■ *Report of Cases*

The present report deals with two instances of "ameloblastic fibroma" which have been seen in the Indiana University School of Dentistry. They are presented in the hope of adding to the limited knowledge regarding this tumor.

CASE 1—A seven year old colored girl entered the University dental clinic on September 13, 1949. Her chief complaint was of toothache in the left side of the mandible. Some swelling was evident. Intraoral examination revealed deeply carious mandibular left first and second deciduous molars.

Routine periapical roentgenograms were made and a portion of a poorly defined radiolucent area distal to the second deciduous molar was noted (Fig. 1, left). Lateral jaw roentgenograms were then obtained and this radiolucent area was found to extend from the crest of the lower alveolar ridge to a point approximately two thirds of the way through the body of the mandible and distally to the anterior border of the ascending ramus (Fig. 1, right). The area measured approximately 2 by 3.5 cm. and, in its distal portion, contained a small poorly calcified mass of tissue resembling an irregular tooth. The developing first permanent molar had been displaced inferiorly until

Assistant professor of oral pathology, department of oral pathology, Indiana University School of Dentistry.

1. Brandon, S. A. Adamantinoma of the left maxillary area: report of case. J. Oral Surg. 7:252 July 1949.

2. Thoma, K. H., and Goldman, H. M. Odontogenic tumors—survey of seventy-five cases. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sec.) 32:763 Dec. 1946.

3. Field, H. J., and Ackerman, A. A. Calcifying fibroadamantoblastoma. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sec.) 28:543 Sept. 1942.

4. Thoma, K. H. Oral pathology, ed. 3. St. Louis. C. V. Mosby Co. 1950, p. 1314.

5. Mann, J. B., and others. Atlas of dental and oral pathology, ed. 3. Chicago. American Dental Association, 1944, p. 206.

6. Thoma, K. H., and Goldman, H. M. Odontogenic tumors; classification based on observations of epithelial, mesenchymal and mixed varieties. Am. J. Path. 22:433 May 1946.

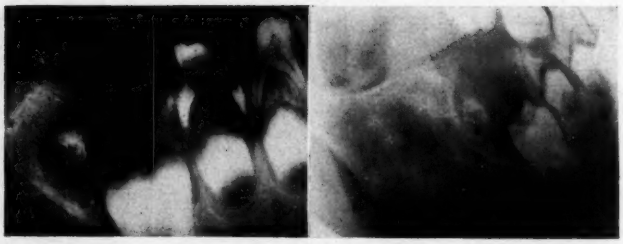

Fig. 1—Case 1. Intraoral and lateral roentgenograms taken at original visit. Radiolucent area in first molar region and malformed second molar are evident

the apexes of the roots were in contact with the inferior border of the mandible and had actually caused some outward growth of the mandible at this point.

The patient at this time had a temperature of 102°F. and therefore was treated with penicillin for four days. She was told to return for further roentgenographic study and surgical exploration of the region but failed to keep her appointment.

The patient was next seen February 27, 1953, when she returned complaining of pain in the region previously described. Roentgenograms at this time revealed that the radiolucent area had increased only slightly in size (Fig. 2). A portion of the third permanent molar crown had also formed distal to the radiolucent area. There appeared to be bulging of the buccal plate of bone, but there was no crepitus.

Under local anesthesia, an incision was made along the crest of the ridge and the mucoperiosteum was reflected. After opening through the bone, a portion of the tumor mass was removed for microscopic examination. The tumor separated very easily from the surrounding bone and, clinically, appeared to show no invasion. The tissue appeared glistening white in color and was very firm and resilient, resembling cartilage in many respects.

Microscopically, the specimen was composed of a mass of young fibrous connective tissue throughout which were scattered islands of epithelial cells (Fig. 3). These epithelial cells showed a variety of patterns including rosettes, long finger-like strands and irregular clumps and, in general, were of a primitive low columnar type resembling preameloblasts.

In some areas these cells were undifferentiated although, occasionally, small clumps of the cells were definitely of a squamous variety. In these latter areas, the squamous cells were invariably associated with irregular bits of calcified material. A considerable amount of brown pigment was found associated with the columnar type cells and this, by Fontana stain against a known control, was shown to be melanin. There was a very small bit of stellate reticulumlike tissue present, bounded by columnar cells in some areas. The connective tissue which made up the bulk of the specimen bore considerable resemblance to primitive dental pulp tissue, although few blood vessels were present. In some areas, however, this connective tissue was hyalinized and showed few cells.

The dental structure involved by the tumor mass and seen in the roentgeno-

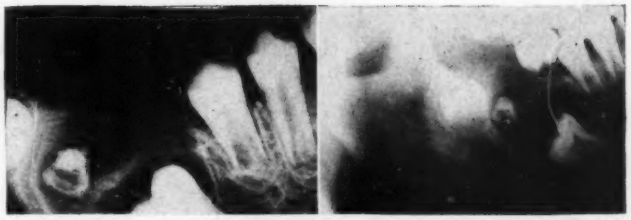

Fig. 2—Case 1. Intraoral and lateral roentgenograms taken at time of second visit, three and a half years later. No great increase in size of radiolucent area is visible

gram consisted of an irregular mass of calcified material in which enamel matrix could be discerned, although generally the material was amorphous. The epithelium associated with this irregular tooth structure was predominantly squamous in type.

After the diagnosis had been established, the mandible was reentered and the remaining tumor mass was enucleated from the bone, after which the region was cauterized. The patient has been examined periodically since the time of surgery, and the defect at present, approximately 18 months after surgery, has almost entirely filled in with new bone.

CASE 2—An 18 year old white girl visited a dentist for a routine checkup before orthodontic procedures were instituted. Full-mouth roentgenographic examination revealed a sharply circumscribed radiolucent area that measured approximately 11 mm. in diameter which was situated between the roots of the mandibular right second bicuspid and first molar (Fig. 4). The lesion was completely asymptomatic and of unknown duration, since there was no record of previous dental roentgenograms. Under block anesthesia, the first molar was extracted, and the entire lesion mesial to this tooth was completely removed. It appeared to consist of a solid mass of soft tissue that separated cleanly from the surrounding bone and, on cut section, was found to be glistening white in color with a cartilaginouslike consistency.

Microscopically, the tissue was composed chiefly of a young fibrous connective tissue containing scattered islands of epithelial cells. This connective tissue resembled the primitive dental pulp, except that it was avascular and exhibited large numbers of fibroblasts interspersed throughout a delicate yet compact type of fibrous tissue. No actual bundles of collagen could be distinguished. In a few areas the tissue appeared to be undergoing early hyalinization. The epithelial cells present exhibited several patterns, being arranged variously in rosettes, short cords and irregular nests. It was noted that the majority of the epithelial cells were arranged around the periphery of the specimen, although clumps of cells were found near the center. These epithelial cells were short columnar or cuboidal in type and, in general, were not well-differentiated. No mitotic figures were noted nor was there any evidence of the formation of stellate reticulumlike tissue. In occasional areas, the tissue was bordered by a definite fibrous capsule although this was not a prominent feature.

The patient has been seen periodically

and at present, approximately 16 months after surgery, the region appears to be nearly filled in with new bone.

■ *Comment*

From the short review of the literature and the two additional instances described herein, it would appear that this particular variety of ameloblastoma occurs more frequently in younger individuals than the more common type. The predominance of occurrence in the mandible as compared to the maxilla is similar, however, and there appears to be no significant sex predilection.

It is interesting that both of the present instances appeared clinically to be well-defined lesions that dissected away from the bone with ease. Histologically, however, the lesions were not encapsulated; in fact, tumor cells actually were noted on the periphery of the specimens.

Although there is no information in the literature to suggest that these tumors

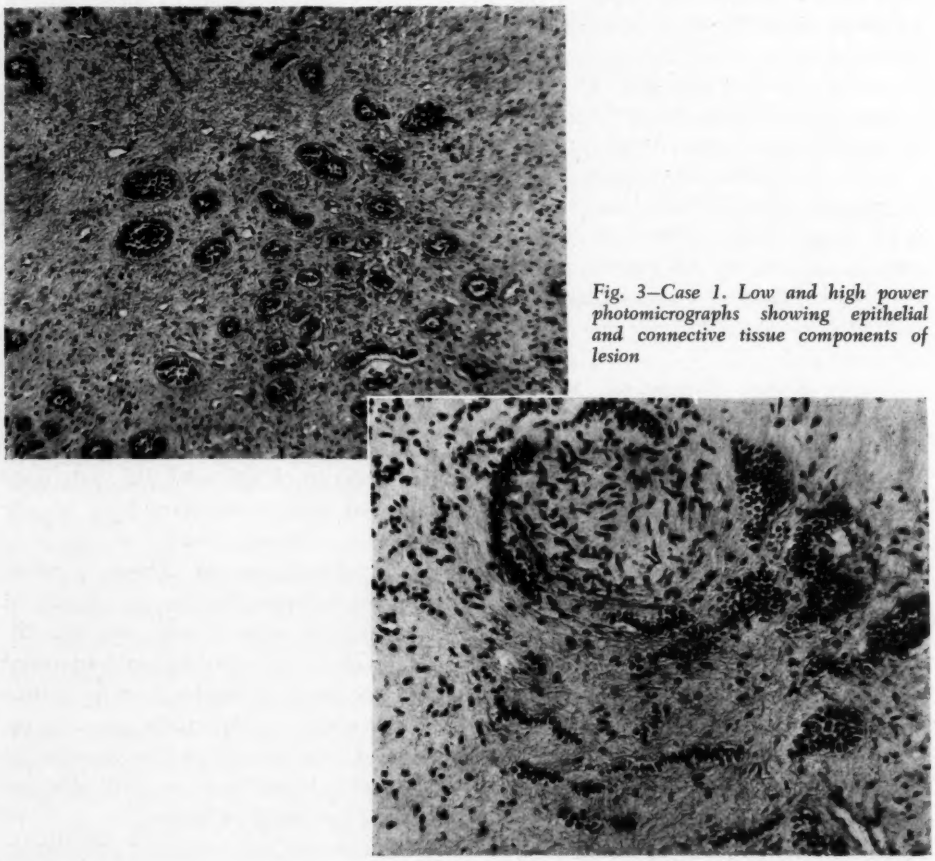

Fig. 3—Case 1. Low and high power photomicrographs showing epithelial and connective tissue components of lesion

may be treated more conservatively than the typical ameloblastoma, it should be pointed out that in both cases presented here, there has been no recurrence to date after rather simple curettage.

■ *Summary*

Ameloblastic fibroma was found to be present in the mandibles of two young patients. These lesions presented a similar clinical appearance at the time of operation and were histologically nearly identical.

Inasmuch as these lesions do not appear to infiltrate bone actively, the possibility of treatment by simple curettage and cauterization is suggested.

Fig. 4—Case 2. Intraoral roentgenogram

Intraoral reduction of maxillary fractures by malar suspension

■ *Melvin J. Sherman, D.D.S., Oakland, Calif.*

Immobilization of maxillofacial fractures by open reduction and internal wire fixation is being more widely used in the field of oral surgery; however, external fixation cannot be discarded as an important adjunct in the treatment of fractures of the facial bones.[1] The choice of appliance to be used should be made by the individual operator who must take into consideration the case at hand.

Dingman[2] and Thoma[3] have described in detail the use of direct wiring of the facial bones, and more recently Lesney[4] described a technic of circumzygomatic wiring for the immobilization of a common type of maxillary fracture. With the advent of antibiotics and chemotherapy, many of the disadvantages of the direct surgical approach have been alleviated, thus excellent end results can be achieved.

Chief of staff, University of California oral surgery service, San Francisco Hospital; instructor in oral surgery, University of California Medical Center.

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2. Dingman, Reed O. Open reduction and internal wire fixation of maxillofacial fractures. J. Oral Surg. 12:140 April 1954.

3. Thoma, Kurt H. Oral surgery, vol. 1, ed. 2. St. Louis, C. V. Mosby Co., 1952, p. 505.

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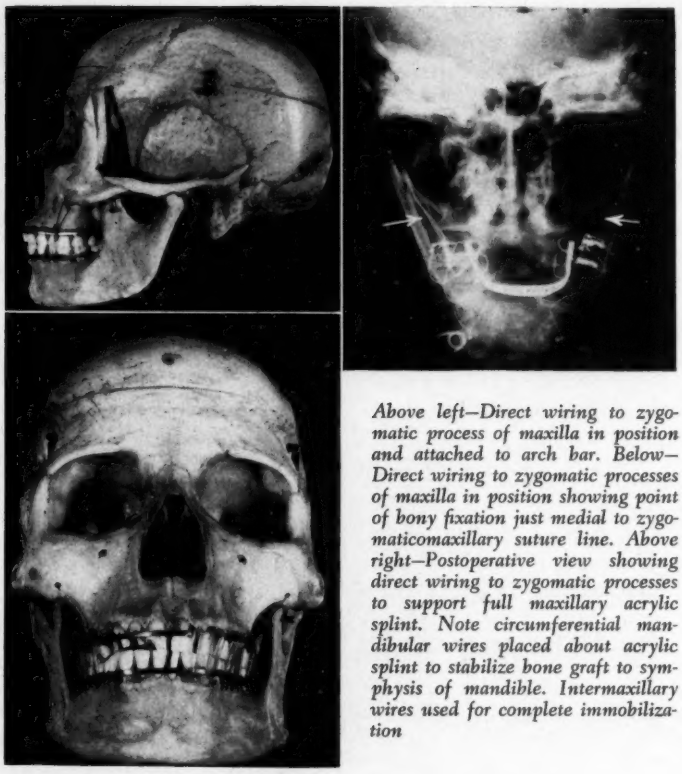

Above left—Direct wiring to zygomatic process of maxilla in position and attached to arch bar. Below—Direct wiring to zygomatic processes of maxilla in position showing point of bony fixation just medial to zygomaticomaxillary suture line. Above right—Postoperative view showing direct wiring to zygomatic processes to support full maxillary acrylic splint. Note circumferential mandibular wires placed about acrylic splint to stabilize bone graft to symphysis of mandible. Intermaxillary wires used for complete immobilization

An intraoral approach for the direct wiring to the zygomatic processes of the maxilla or the anterior inferior surfaces of the malar bones will be described. Obviously, if this procedure is to be followed, one or both of the malar bones or zygomatic processes of the maxilla must be intact. This is determined before treatment by thorough clinical and roentgenographic study.

■ *Technic*

The anterior portion of the inferior border of the malar bone is palpated intraorally and followed until it turns mediad ward to join the maxilla. A longitudinal incision approximately 2 cm. in length is made at this point high in the buccal sulcus which is carried down to the inferior border of the malar bone. By making the incision at this point the exposure comes between the zygomatic head of the quadratus labii superioris muscle, which arises from the malar surface of the zygomatic bone immediately behind the zygomaticomaxillary suture, and the infraorbital head of the quadratus labii superioris muscle, which arises from the lower margin of the orbit immediately above the infraorbital foramen. A small periosteal

elevator is used to expose the inferior border and a small portion of the anterior surfaces of the malar bone and zygomatic process of the maxilla. The zygomaticomaxillary suture line must now be identified.

Suitable retractors are used to keep the field exposed, and a point just medial to the zygomaticomaxillary suture line and approximately 1 cm. superior to the lower border is selected. A straight dental handpiece and an appropriate bone drill are used to make a hole through both plates of bone.

A piece of .018 or .016 annealed stainless steel wire is then passed through the hole, grasped beneath the zygomatic process of the maxilla with a curved hemostat, and drawn into the mouth. The incision is then closed with sutures and the two ends of the stainless steel wire are left projecting into the mouth (illustration, above left). The procedure is repeated on the opposite side (illustration, below). The stainless steel wires passing through the zygomatic processes of the maxilla are then attached to arch bars, dentures, splints or any other type of intraoral appliances that are used in the plan of treatment (illustration, above right).

At the completion of treatment it is a simple matter and causes the patient little discomfort to cut and remove the wires that pass through the malar bones or zygomatic processes of the maxilla.

■ *Summary*

Direct wiring to the facial bones provides a means of complete and accurate reduction and immobilization of maxillary fragments. Cumbersome and complicated external appliances can be eliminated in many instances and this makes the treatment period more comfortable for the patient.

One advantage of direct wiring to the zygomatic processes of the maxilla or to the malar bones by intraoral approach is that it is a relatively simple procedure and, if approached in the manner described, no important structures will be encountered. It is particularly advantageous, also, because it helps to control prosthetic appliances in an edentulous maxilla. In addition, it is advantageous where bilateral fractures of the maxilla do not involve the zygomatic processes or the malar bones.

The disadvantage is that its use depends on the stability of one or both zygomatic processes of the maxilla or the malar bones. Its use is limited to immobilization and simple reduction, since radical reduction, if necessary, must be accomplished by other means.—447 *Twenty-ninth Street.*

■ Disciplined Study

Experiment, directed by the disciplined imagination either of an individual or, better still, of a group of individuals of varied mental outlook, is able to achieve results which far transcend the imagination alone of the greatest philosopher. *Lord Rutherford.*

Antibiotic synergism and antagonism: review of the literature

■ *Irwin A. Small, D.D.S., Detroit*

The increasing number of effective antibiotics has revolutionized the treatment of infectious disease. The microbial world has reacted to the administration of these drugs with the acquisition of resistance and drug-fastness. To subdue bacteria resistant to specific antibiotics, clinicians have used combinations of several agents. The increasing trend toward indiscriminate use of combined antibiotic therapy not only has failed to produce spectacular advances in therapeutic results, but has resulted in the sensitization of many persons to these drugs and has favored the large-scale emergence of drug-resistant strains of bacteria. The futility of such an arbitrary approach has been emphasized by the demonstration of antagonism between antibiotics both experimentally[1, 2] and clinically.[3, 4] Thus it is clear that antibiotics should not be combined haphazardly, and synergistic combinations should be used only when indicated.

Despite years of intensive investigation, the exact mechanism of action is not known for a single antibiotic drug. It seems futile, therefore, to approach the problem of combined antibiotic action from the theoretical side. Nevertheless, an over-all evaluation of antibiotic relationships is urgently needed if useful combinations are to be employed rationally and harmful combinations are to be avoided.

Jawetz and Gunnison[5] have reported an empirical plan of combined antibiotic action. The plan has been derived from an integration of results of experimental studies *in vivo* and *in vitro,* and it is in agreement with all conclusive clinical demonstrations thus far reported of antibiotic synergism and antagonism. It makes no claim to be all-inclusive and may well have to be modified as new facts become established.

This article will review the work of Jawetz, Gunnison and others in this field, and will discuss some of the questions concerning the combined effect of two antibiotics.

When two drugs act simultaneously on a microbial population, they may show one of the following effects as compared to the action of a single drug: (1) indifference—no increased or decreased action;

Presented as part of a seminar to the faculty of Washington University Dental School, St. Louis, Mo., Oct. 1953.

Graduate student in oral surgery, Washington University Dental School, St. Louis.

1. Jawetz, E.; Gunnison, J. B., and Coleman, V. R. Combined action of penicillin with streptomycin or chloromycetin on enterococci in vitro. Science 111:254 March 10, 1950.

2. Jawetz, E.; Gunnison, J. B., and Speck, R. S. Studies on antibiotic synergism and antagonism: interference of Aureomycin, chloramphenicol and Terramycin with action of streptomycin. Am. J. M. Sc. 222:404 Oct. 1951.

3. Lepper, M. H., and Dowling, H. F. Treatment of pneumococcic meningitis with penicillin compared with penicillin plus Aureomycin; studies including observations on apparent antagonism between penicillin and Aureomycin. A.M.A. Arch. Int. Med. 88:489 Oct. 1951.

4. Cates, J. E.; Christie, R. V., and Garrod, L. P. Penicillin-resistant subacute bacterial endocarditis treated by combination of penicillin and streptomycin. Brit. M. J. 1:653 March 31, 1951.

5. Jawetz, E., and Gunnison, J. B. Studies on antibiotic synergism and antagonism: scheme of combined antibiotic action. Antibiotics & Chemother. 2:243 May 1952.

Table

Synergism and antagonism in treatment of subacute streptococcal infection in mice

Dose 24 hr. after infection	Percentage mice saved
Synergism	
9 micrograms penicillin	15
500 micrograms streptomycin	10
9 micrograms penicillin plus 500 micrograms streptomycin	75
Antagonism	
180 micrograms penicillin	100
15 micrograms oxytetracycline	15
180 micrograms penicillin plus 15 micrograms oxytetracycline	45

(2) synergism—increased action, or (3) antagonism—decreased action.

Antagonism is defined as a considerable decrease in the rate of bactericidal action and a reduction in the rate of cure of infections, below that observed with a single drug. Synergism is defined as the ability of two drugs to increase considerably the rate of early bactericidal action, or the rate of cure of experimental or clinical infections beyond that obtained by simple additive effects of the agents.[1, 5-7]

Speck, Jawetz and Gunnison[8] demonstrated synergism and antagonism *in vivo* in the treatment of a subacute streptococcal infection of mice (see table).

■ *Antagonism*

Experimental evidence indicates that chlortetracycline, chloramphenicol, oxytetracycline and the sulfonamides may interfere with the action of penicillin or of streptomycin in the test tube and in infections in experimental animals.[8] One convincing clinical report pointed to the possible interference of chlortetracycline with the therapeutic effect of penicillin in pneumococcic meningitis.[3] The following generalizations can be made from available facts regarding the occurrence of antagonism among antibiotics:

1. Antagonism is observed only when a bactericidal or therapeutically effective concentration of one drug is added to a relatively inactive concentration of the other. A large excess of either drug, however, might overcome the antagonism.[9]

2. The interference of a combination of antibiotics has been attributed to the fact that "bactericidal" drugs such as penicillin or streptomycin act optimally on multiplying microorganisms, and drugs such as chlortetracycline and chloramphenicol, which are principally bacteriostatic, consequently interfere with the "bactericidal" agents.[10]

6. Gunnison, J. B.; Jawetz, E., and Coleman, V. R. Effect of combinations of antibiotics on enterococci in vitro. J. Lab. & Clin. Med. 36:900 Dec. 1950.

7. Jawetz, E., and Gunnison, J. B. Experimental basis of combined antibiotic action; report to Council on Pharmacy anl Chemistry. J.A.M.A. 150:693 Oct. 18, 1952.

8. Speck, R. S.; Jawetz, E., and Gunnison, J. B. Studies on antibiotic synergism and antagonism; interference of Aureomycin and Terramycin with action of penicillin in infections in mice. A.M.A. Arch. Int. Med. 88:168 Aug. 1951.

9. Ahern, J. J.; Burnell, J. M., and Kirby, W. M. M. Lack of interference of chloramphenicol with penicillin in hemolytic streptococcal infection in mice. Proc. Soc. Exper. Biol. & Med. 79:568 April 1952.

10. Jawetz, E., and others. Studies on antibiotic synergism and antagonism; interference of chloramphenicol with action of penicillin. A.M.A. Arch. Int. Med. 87:349 March 1951.

3. Antibiotic antagonism is not the result of chemical or physical interference with the action of drugs.[10]

4. The interfering agent must act before, or simultaneously with, the effective one, and not later. This limitation is most pronounced in the sulfonamides, which must act for some hours prior to penicillin in order to antagonize it *in vitro* or *in vivo*.[11]

5. Antagonism is greatest with concentrations of the interfering drugs that are barely biologically active. The phenomenon is suppressed by a great excess of either of the participating agents.[2, 6, 8, 10]

Antagonism has been demonstrated clinically. Lepper and Dowling[3] reported the death of 30 per cent of a group of 43 patients with pneumococcic meningitis treated with massive parenteral doses of penicillin. Among 14 similar patients treated with chlortetracycline plus penicillin, 79 per cent died. There was no essential difference between the two groups with respect to age, number of organisms in the spinal fluid, or the presence of other diseases. Lepper and Dowling concluded that penicillin and chlortetracycline should never be administered together, even for patients with mild infections, when antagonism has been shown by *in vitro* tests.

Ahern and Kirby[12] disputed the conclusion of Lepper and Dowling and pointed out that chlortetracycline and penicillin have not been shown to be mutually antagonistic in clinical doses. In pneumococcic meningitis, the killing action of penicillin (which is prevented by a bacteriostatic drug) is probably necessary in most instances to bring about a cure, since phagocytosis has been shown to be relatively ineffective in the subarachnoid space.[12] In dentistry an analogous situation might exist when combinations of bacteriostatic and bactericidal antibiotics are used in root canal therapy. In most other infections, phagocytosis usually is effective, beginning early in the course of the illness. Therefore, antagonism between bactericidal and bacteriostatic antibiotics very infrequently is seen clinically.

■ *Synergism*

The following generalizations can be made from available facts regarding the occurrence of synergism:

1. Synergism is demonstrated when an apparently ineffective concentration of one antibiotic is added to a somewhat active amount of another.[13]

2. A synergistic drug pair acts rather uniformly on the exposed microbial population, resulting in early, rapid and complete killing. One of the outstanding characteristics is the prompt increase in rate of bactericidal action when one member of a synergistic pair is added to the other *in vitro*.[13]

3. There is no evidence to suggest that the two drugs of a synergistic pair

11. Gunnison, J. B., and others. Studies on antibiotic synergism and antagonism; effect of sulfadiazine on action of penicillin in vitro and in vivo. Antibiotics & Chemother. 1:259 July 1951.

12. Ahern, J. J., and Kirby, W. M. M. Lack of interference of Aureomycin with penicillin in treatment of pneumococcic pneumonia. A.M.A. Arch. Int. Med. 91:197 Feb. 1953.

13. Miles, C. P., and others. Antibiotic synergism requires simultaneous presence of both members of synergistic drug pair. Proc. Soc. Exper. Biol. & Med. 78:738 Dec. 1951.

combine chemically to form a compound more effective than either drug alone.

4. Antibiotic synergism requires simultaneous presence of both drugs.[13]

5. With a synergistic pair of drugs, the effect is demonstrable over a wide range of doses.[5]

6. Of the members of a synergistic pair, apparently only one need exhibit measurable biological effect of the concentration entering into synergism. The other must show some effect but only in a much higher concentration.[5]

The available basic information about combined antibiotic therapy makes it possible to approach the subject rationally. It must be stated emphatically, however, that fixed synergistic or antagonistic drug pairs do not exist. A given combination might be synergistic against one microorganism and antagonistic against a second, and indifferent when acting on a third. The behavior of the microorganism in question, and not chemical or physical interaction of the drugs, determines the result of combined antibiotic action. Generalizations, therefore, are impossible for the behavior of drug pairs, even for their behavior against a given species of bacteria, because individual strains differ greatly in their susceptibility to different antibiotics.

Klein and Schorr,[14] in studying antibiotic synergism and antagonism, found that the property of the test strain associated with synergism or antagonism was the rate at which the organism became resistant to each of the antibiotics. When bacteria promptly became resistant after growth in each of two antibiotics, the combination of the two drugs resulted in a combined effect that was frequently synergistic and never antagonistic. When bacteria did not become resistant promptly to either antibiotic, synergism rarely occurred and antagonism was observed frequently.

■ *Grouping of Antibiotics*

The common and clinically useful antibiotics may be hypothetically arranged in two groups.

Group 1 is composed of penicillin, streptomycin, bacitracin and neomycin. The drugs in this group act most efficiently against rapidly multiplying bacteria, and their bactericidal concentrations often are not much larger than the bacteriostatic ones. Members of Group 1 are frequently synergistic with each other, are occasionally indifferent, but have never been antagonistic to each other. To be an effective member of a synergistic pair, a drug must have some action against the microorganism, although a very large dose of the drug (far in excess of the amount showing synergism) might be necessary to demonstrate such action in the test tube. With this reservation, the members of Group 1 are often interchangeable in synergistic combinations.

Group 2 is composed of chlortetracycline, chloramphenicol, oxytetracycline and tetracycline. The drugs in this group are principally bacteriostatic.[15] Members of Group 2 are neither synergistic with, nor antagonistic to, each other; simple

14. Klein, M., and Schorr, S. E. Role of bacterial resistance in antibiotic synergism and antagonism. J. Bact. 65:454 April 1953.

15. Jawetz, E. Antibiotic synergism and antagonism; review of experimental evidence. (Almoth Wright lecture.) A.M.A. Arch. Int. Med. 90:301 Sept. 1952.

additive effects, however, are observed. Presumably this effect is also obtainable by an increase in the dose of a single drug.

Sulfonamides probably fit into Group 2, although the evidence is incomplete. In spite of exhaustive tests, the place of polymyxin B in the scheme remains uncertain.[11]

Combined effects between drugs of Group 1 and Group 2 are the most complex and depend on the relative susceptibility of the microbial strain. If the microorganism is susceptible to the Group 1 drug, then Group 2 agents will frequently be antagonistic and reduce the effect of the Group 1 drug. This effect seems to be unilateral. Group 1 drugs do not interfere with Group 2 action against organisms tested thus far. If, on the other hand, the bacterium is Group 1 resistant, then Group 1 plus Group 2 antibiotics sometimes result in synergism, never in antagonism.[5]

On the basis of evidence summarized in this paper, certain definite recommendations may be made for the rational use of antibiotics. Whenever feasible, the etiologic agent should be isolated in patients with infectious disease, and the single drug most likely to affect the organism should be employed in treatment. In dentistry, penicillin is still the best single agent for treatment of oral infections. When a resistant organism is found, simple laboratory tests often are helpful in finding the drug most likely to succeed. When a microorganism is resistant to most single agents, laboratory examination will frequently find synergistic drug combinations.

In general, it may be considered safe to combine agents of Group 1. Such combinations may be ineffective, but, as stated previously, they are not infrequently synergistic and are never antagonistic. Penicillin and streptomycin have proved most effective in dentistry, where penicillin alone appears to be ineffective. This combination probably affords the best protection for patients with rheumatic or congenital heart defects.

The simultaneous administration of several drugs of Group 2 appears illogical unless warranted by pharmacologic reasons, such as toxic side effects or differences in absorption. On the basis of demonstrated antibiotic antagonism, it appears undesirable to add Group 2 drugs to a Group 1 agent if the infecting microorganisms are susceptible to the latter. The addition of a Group 2 antibiotic to a Group 1 antibiotic is warranted only if based on laboratory evaluation suggesting synergism.[5]

■ *Summary*

The experimental basis and a tentative scheme for the combined action of antibiotics are reported. The variation in the response of microbial strains to drug combinations is stressed. This variation emphasizes the impossibility of labeling certain drug pairs as synergistic or antagonistic and stresses the desirability of laboratory guidance in those occasional difficult situations in which drug combinations are essential for cure.[7]—*20050 Votrobeck Court.*

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Cementoma of the mandible:
report of case

■ *Sanford M. Moose, D.D.S.; Wilber K. Wirtz, D.D.S., and John K. Young, D.D.S., San Francisco*

The patient, a well developed, well nourished, middle aged woman, came for examination on March 16, 1950. Her chief complaint was a swelling of the right side of the jaw and face that had been slowly increasing during the previous 11 years.

HISTORY—The swelling had first become apparent in 1939. The gradual increase in size had been painless for ten years; in December, 1949, however, the jaw had for the first time become painful. At that time, a biopsy had been obtained elsewhere with no apparent results. Increasing discomfort eventually resulted in the patient's being referred to us for care.

PHYSICAL EXAMINATION — Considerable swelling of the right side of the face and jaw was apparent immediately. It extended from a point below the tragus of the ear into the submaxillary region below and then anteriorly and superiorly to the ala of the nose (Fig. 1, left). Intraoral examination revealed a hard, expansive tumor involving the right side of the mandible and extending from the angle to the second bicuspid region (Fig. 1, below left). The mass was ovoid in shape, with approximate measurements of 6 by 3 by 4 cm. The molar teeth were missing, and the alveolar mucosa was edematous and cyanotic in appearance. A crater-like opening was present in the superior surface of the tumor, and suppuration was evident in this region. Temperature was 102° F.

TREATMENT—Since the maxillary right molar teeth extended into the crater-like opening in the superior surface of the mandibular tumor, it was decided to extract the offending teeth to obtain relief from this obvious trauma. Extraction was accomplished with considerable difficulty because of apparent ankylosis between the roots of the maxillary second and third molars and the investing alveolar bone. At this time, a biopsy of the tumor was also obtained. Postoperative reaction to the extraction was considerable with an exacerbation of symptoms in the mandibular region, accompanied by sublingual and submaxillary lymphadenitis. Adequate penicillin therapy was instituted which resulted in gradual diminution of symptoms. The biopsy report was noninformative; however, excision of the tumor was obviously indicated. After some deliberation it was decided to remove the tumor intraorally but to obtain additional support by application of a Roger Anderson external fixation appliance (Fig. 1, below right). The appliance was used in order to prevent displacement of the mandibular fragments if a fracture ensued during removal of the tumor.

OPERATION—After adequate preoperative sedation, regional anesthesia was obtained by local nerve block and infiltration of the soft tissues investing the mandible. A long sweeping incision was made that extended along the crest of the ridge from the region of the cuspid to a point on the anterior surface of the ramus

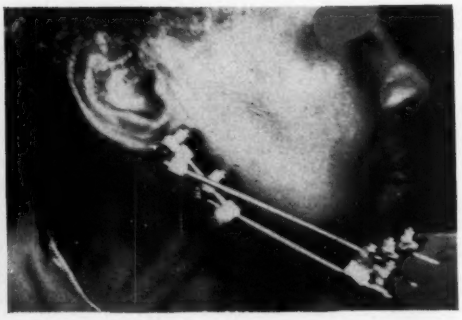


Fig. 1—Left: Preoperative view. Below left: Preoperative roentgenograms of right side of mandible. Below right: Roger Anderson skeletal fixation appliance in place prior to operation

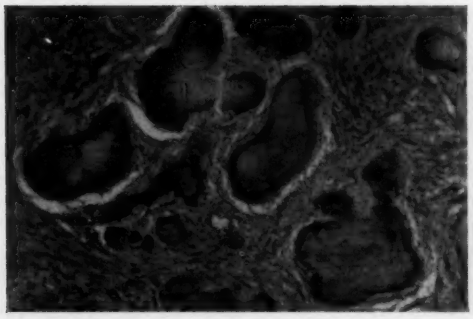


Fig. 2—Left: Photomicrograph of microscopic slide. Right: Roentgenogram taken several weeks after operation

approximately 1 cm. below the coronoid process. After elevation of the mucoperiosteal flaps that enveloped the mandible, the tumor mass was sectioned and removed which left a thin capsule of bone. Bleeding during the procedure was moderate and gave rise to no real concern at any time. The wound was closed primarily without packing.

Postoperative convalescence was uneventful, with the patient receiving routine postoperative care and medication.

PATHOLOGIST'S REPORT—The microscopic examination showed many islands of varying sizes of cementum surrounded by young fibrous tissue (Fig. 2, left). Arteries and veins filled with erythrocytes were dispersed throughout the connective tissue. There was a gradual coalescence of the islands of cementum as the center of the mass was approached. There were indications of recent hemorrhage, probably because of surgery. Masses of leukocytes, primarily of the polymorphonuclear type, were also visible. The pathologist's diagnosis was "cementoma."

COMMENT—Observation was continued at infrequent intervals until June 16, at which time the patient was dismissed (Fig. 2, right). It was of interest to note that she acquired a speech impairment which lasted for approximately the same length of time as the period of convalescence. Although it was impossible to evaluate the cause of this impediment accurately, it was our impression that it was an hysterical aphasia.—*450 Sutter Street.*

Mucous cyst of the lower lip in a 12 month old infant: *report of case*

■ *Ernest Baden, D.D.S., New York*

Retention cysts of the salivary mucous glands occur on the lips, floor of the mouth, tongue, palate and cheeks. Little is known regarding the relative frequency of their appearance in different age groups. Retention cysts of the lower lip,[1] also known as mucoceles or mucous cysts, seem to occur more often in teen-agers[2] and young adults.[3] They are located on the mucosal aspect of the lower lip, usually in the lateral portion. Cysts of this type vary in size and shape from that of a small pea to that of a large bean or even larger, as illustrated in the instance reported herein. The cyst has the appearance of a translucent swelling of the mucosa. The membrane usually is bluish in color, but may be yellow or white. The lesion has a broad base which is soft and self-limiting. Histologic examination will show a typical inclusion cyst lined with epithelium derived from the mucous gland duct. The cyst cavity contains mucus, leukocytes, fibrin and other inflammatory cells. In the case described herein, the cyst interfered with feeding and resulted in considerable distress to the baby, whose erupting deciduous teeth irritated the lesion of the lower lip.

1. Thoma, K. H. Diagnosis and treatment of salivary cysts and stones. Oral Surg., Oral Med. & Oral Path. 3:1087 Sept. 1950.
2. Hurt, W. C. Mucous cysts. Oral Surg., Oral Med. & Oral Path. 3:425 April 1950.
3. Hecht, S. S. Retention cysts of the lip (mucocele). Am. J. Orthodont. & Oral Surg. 25:89 Jan. 1939.

Fig. 1—Mucous cyst of lower lip located on transitional mucosa opposite right lower cuspid region

REPORT OF CASE—In June 1953, a well developed, well nourished, 12 month old white male infant was brought to the dental clinic for consultation and therapy. The mother had brought the baby in for pediatric consultation with the complaint that a growth was present on the right side of the lower lip which caused the child considerable discomfort (Fig. 1). The lesion was being irritated by the erupting deciduous teeth. The mother stated that a growth had been noticed immediately after birth, at which time it had been very small and therefore did not cause concern. During the six months preceding her visit, however, growth had been rapid and had interfered with normal feeding.

Clinical examination revealed an active male infant, with no extraoral swelling or adenitis. Intraoral examination revealed a smooth, spherical tumorlike mass, about 1.5 cm. in diameter. The lesion was soft, spongy, filled with a thick fluid, well defined and apparently encapsulated, and it had a large pedunculated base, 1 cm. in diameter. There was no evidence of induration or invasion of other structures. The mucosal aspect was smooth, white and shiny. The lesion was located near the transitional mucosa of the lower lip, about 4 mm. from the right labial commissure and opposite the anterior deciduous teeth on the right side. When the infant closed his mouth, the upper anterior teeth were in such a position that they traumatized the lesion. All other oral structures appeared to be essentially normal.

A provisional diagnosis of mucocele of the lower lip was made and the patient was admitted to the hospital.

Physical and laboratory examinations were negative. The lesion was excised under general anesthesia in the usual manner. The surgical specimen was fixed and sent to the laboratory for examination. The pathologist's report confirmed the provisional diagnosis and a final diagnosis of mucous salivary gland inclusion cyst was made (Fig. 2).

The clinical course was uneventful, and the wound was completely healed after one week. Follow-up examinations showed no recurrence six months after surgery.

DISCUSSION—Mucous gland cysts, also known as mucoceles and salivary gland inclusion cysts, are found more frequently in the lower lip. Their pathogenesis is best explained by the occlusion of the mucous gland duct and the consequent slow accumulation of mucus which results in swelling and subsequent breakdown of the inclusions. Their etiology is diffi-

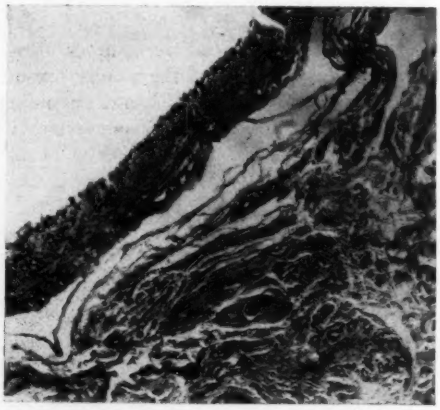


Fig. 2—Section of epithelial lining and underlying connective tissue stroma

cult to determine. Chronic irritation caused by biting, injury or scar tissue formation has been mentioned by some authors. They are rarely seen in young infants, or they are so small in size that their occurrence may go unnoticed.

Complete surgical excision is the treatment of choice. Removal of mucous cysts in children is indicated when irritation of the growth becomes apparent. The irritation may be caused by the eruption of teeth or biting and may result in further expansion of the lesion.

An accurate differential diagnosis should be made in all cases, and a histologic examination should be done routinely to confirm the provisional diagnosis.

SUMMARY AND CONCLUSION—A mucous cyst of the lower lip was found in a 12 month old infant. The mother had first noticed the cyst shortly after birth. The lesion was larger than usual. It was excised under general anesthesia and the diagnosis was confirmed by histopathologic examination.

This case illustrates the fact that mucous cysts may develop in very young children and that they may become large enough to produce subjective symptoms. Lesions and tumors in the oral cavity are not exceptional in infants. A thorough extraoral and intraoral examination should be an integral part of the pediatric examination for early detection of any abnormalities present in the mouth.—*342 Madison Avenue.*

Ankylosis of the mandible:
report of case

■ *Gerald Beiter, D.D.S., Austin, Texas; E. C. Hinds,* D.D.S., M.D., and S. Duane Waggoner,† D.D.S., Houston, Texas*

Ankylosis of the mandible involving the coronoid process has been described in several articles.[1-4] In a review of bone metabolism by Converse and Campbell,[5] it was pointed out that bone may be deposited in other regions of connective tissue as well as those predestined for bone. A case of heteroplastic bone formation in the cheek has been reported by Bernier and Krogh.[6]

The following case is a civilian injury involving a true bony ankylosis of the coronoid process and the adjacent zygomatic arch, subsequent to a fracture of the arch.

Previous authors have described surgical correction of coronoid ankylosis by means of an intraoral approach.[1-3] In the case to be discussed, an intraoral approach was attempted but proved ineffective because of the size of the osteogenic process and because of the absolute ankylosis. Adequate exposure was ob-

*Bertner professor of surgery, University of Texas Dental Branch.

†Resident, oral surgery, Jefferson Davis Hospital.

1. Anderson, C. F., and Smith, Leroy. Surgical treatment of a complete unilateral fibrosis of the temporal muscle: report of case. J. Oral Surg. 11:238 July 1953.

2. Brown, J. B., and others. Ankylosis of coronoid process of mandible (and associated scar limitation of jaw function). Plast. & Reconstruct. Surg. 1:284 Nov. 1946.

3. Lewis, G. K. Treatment of old depressed fractures of the zygoma. J. Oral Surg. 11:101 April 1953.

4. Martin, B. C. Role of the coronoid in ankylosis of the jaw. Oral Surg., Oral Med. & Oral Path. 2:984 Aug. 1949.

5. Converse, J. M., and Campbell, R. M. Bone grafts in surgery of the face. In The surgical clinics of North America, April, 1954. Philadelphia, W. B. Saunders Co., 1954, p. 375-401.

6. Bernier, J. L., and Krogh, H. W. Heteroplastic bone formation in the cheek. J. Oral Surg. 7:353 Oct. 1949.

tained, however, using a Weber-Ferguson cheek flap.

HISTORY—A well developed, well nourished, 43 year old negro man reported to the Jefferson Davis Hospital clinic on March 29, 1954, mainly because of a toothache. His teeth were fixed in centric occlusion (Fig. 1, left). The patient gave a history of having been in an automobile accident in 1946, at which time he sustained multiple fractures, including a fracture of the right zygomatic arch. This was

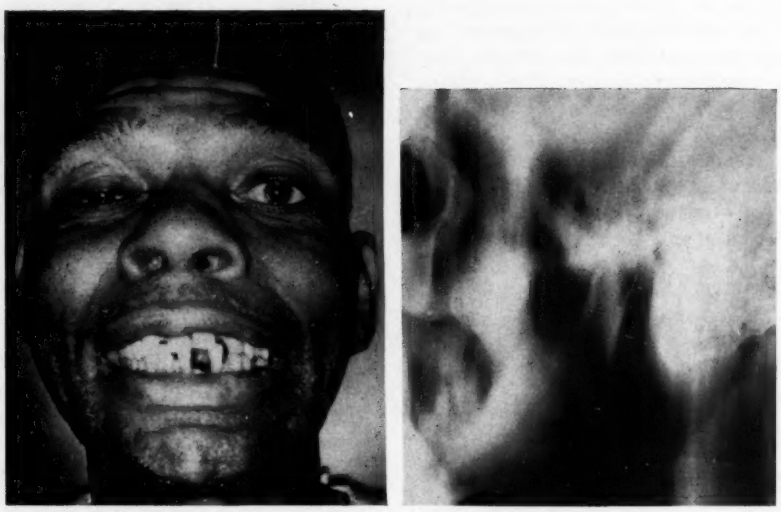


Fig. 1—Left: Preoperative view of patient with absolute ankylosis. Right: Preoperative laminagram demonstrating excessive deposition of bone

Fig. 2—Left: Immediate postoperative view of patient. Center: Postoperative roentgenogram. Right: Patient six weeks after surgery

treated at the time of injury. The patient stated, however, that at the time he was dismissed from the hospital, the opening of his mouth had been limited to 1 cm. in the region of the anterior teeth. The patient related that approximately nine months later he had suffered a recurrence of the fracture while he was eating a chicken bone. After this latter incident, he had gradually developed an absolute ankylosis. For the past three years, he had been unable to open his mouth at all.

PHYSICAL EXAMINATION—There was negligible movement of the mandible when the patient attempted to open his mouth. A nodular mass could be palpated over the right zygomatic arch, in the coronoid region. Most of the teeth were present.

ROENTGENOGRAPHIC EXAMINATION—The laminagrams of the temporomandibular joints did not reveal any significant abnormality of the condyle (Fig. 1, right). There was, however, an old fracture of the zygomatic arch on the right side with displacement of the midportion of the arch inward. In addition, laminagrams demonstrated considerable deformity in the region of the coronoid process, characterized by excess bone deposition which produced the appearance of an actual osteoma. There appeared to be an extensive direct union between the zygomatic arch and the coronoid process.

LABORATORY EXAMINATION—Urinalysis revealed no abnormality. Serological tests were negative. The white blood cell count was 5,500, and the differential count was within normal limits. Hemoglobin was 14.6 Gm.

OPERATIVE PROCEDURE—On April 14, under general anesthesia, an intraoral incision was made along the anterior border of the ascending ramus. An unsuccessful attempt was made to obtain adequate exposure of the coronoid region. An external approach utilizing a Weber-Ferguson flap (Fig. 2, left) then was obtained reflecting the right cheek laterally. This provided excellent exposure of the involved region. There was a considerable deposition of bone in the zygomatic arch in the coronoid region, creating one solid mass. The bone, including the coronoid process, was removed with mallet, chisel and bone rongeur forceps. The zygomatic arch was reduced to its approximately normal contour (Fig. 2, center). Hemostasis was effected. The wound was closed in layers using no. 000 interrupted chromic catgut sutures in the deep tissues and no. 0000 black silk sutures in the skin. A rubber drain was inserted in the mucosal incision opposite the anterior border of the ramus, and a pressure dressing was applied externally. The patient was adequately medicated with streptomycin and penicillin as prophylaxis against infection after surgery.

The postoperative course was uneventful. The patient was dismissed from the hospital April 21, and periodic check-ups have been made in the outpatient clinic since then.

After surgery a clothespin-type bite opener was given to the patient to be used at frequent intervals. It was impossible, however, to increase the jaw opening beyond 1 cm. with this kind of appliance. Consequently, an elastic traction type of bite opener appliance as described by Blair, Ivy and Brown[7] was constructed, and improvement was noticeable in a short time. The appliance has been used at periodic intervals ever since. The patient now has an opening of 2.5 cm. in the region of the incisor teeth and is able to eat solid foods without difficulty. There is minimal scarring from the external incision (Fig. 2, right), and function of the mandible is very good.

SUMMARY—A case is presented which involves a civilian injury of an old zygomatic fracture that had been repaired and later apparently refractured and depressed, with development of excessive bone deposition. Subsequently, considerable exostosis formed in the region of the coronoid process, thus uniting the zygomatic arch to the coronoid process and producing an absolute ankylosis. An intraoral approach was attempted and found to be in-

7. Blair, V. P.; Ivy, R. H., and Brown, J. B. Essentials of oral surgery, ed. 3. St. Louis, The C. V. Mosby Co., 1944, p. 623.

adequate. An extraoral incision of the Weber-Ferguson type was made, and the cheek was reflected laterally.

Previous objections to an external approach for this problem have been as follows: (1) danger to the facial nerve and (2) difficulties and complications in regard to the parotid gland. The approach as used in this instance seemed to avoid both of these difficulties. External deformity caused by scarring was insignificant.—*1307 Capitol National Bank Building.*

Paget's disease: *report of case*

■ *Max B. Winslow, D.D.S., Detroit*

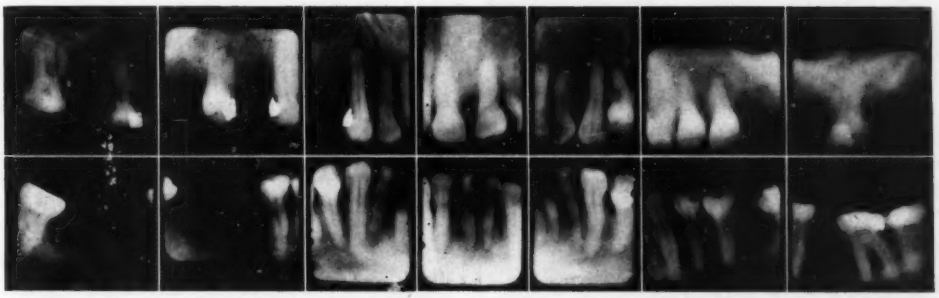
Paget's disease or osteitis deformans is a skeletal disease marked by rarefying osteitis with distortion of the bones affected. It occurs in middle life or later and causes a thickening and deformity of the bones involved. The disease is progressive but does not, as a rule, shorten life. The nature and etiology is unknown. It does not involve the entire skeleton; the number of bones involved varies. The most common sites are the femur and tibia, the pelvis, the vertebrae, and the maxilla. A feature is the thickening of the calvaria which causes gradual increase in the size of the head. The facial bones may be enlarged, simulating the appearance of leontiasis ossea. When the maxilla is involved (the maxilla is more often affected than the mandible), a thickening of the alveolar process occurs. The jaw often shows changes before symptoms appear in the rest of the skeleton. The cortex as well as the spongiosa is affected. The process is very slow as compared with hyperparathyroidism and results in an increase in the volume of bone, which becomes thick although porous.

Laboratory findings show no change in blood calcium and phosphorus levels, but do show a definite increase in serum phosphatase. Roentgenographic study reveals areas of osteoporosis in the early stages of the disease and later a pebbly or mosaic pattern of bone. No special form of treatment has been generally accepted. Diets high in calcium, phosphorus and vitamin D have been found to be beneficial.

REPORT OF CASE—A man, aged 60, complained of dull, intermittent pain in the right maxillary molar region of several weeks' duration. For several months he had experienced "dizzy spells" associated with a sensation of weakness in the arms and legs.

EXAMINATION—Oral examination revealed a partially edentulous mouth. The gingival tissues were within normal limits in color, form, density and attachment. Dental roentgenograms (illustration) revealed large areas of osteoporosis in the cuspid and incisor regions of the maxilla and the incisor region of the mandible. There was also a pebbly mosaic pattern of bone in the maxillary bicuspid and molar regions. In the areas of osteoporosis, decalcification extended into the alveolar crests. The roentgenographic and clinical picture was suggestive of osteitis deformans (Paget's disease). Roentgenographic study of the spine, pelvis and long bones showed no bony abnormality; however, osteoporosis of the circumscribed type that involved the frontal and right parietal bones was found. This was not

Associate attending dentist and chief of section of periodontics, Sinai Hospital.



Complete dental roentgenograms showing extensive osteoporosis with loss of normal bony architecture in the maxillary alveolus and, to a lesser degree, in the mandibular incisor area

associated with any evidence of increased intracranial pressure or tumor shadow. Some of the facial bones showed roentgenographic evidence of a slight increase in density.

Routine blood counts were done and were within normal limits. Results of the Wassermann test were negative, urinalysis was normal and the glucose tolerance test was within normal range. Blood calcium and phosphorus were normal with levels of 10.5 and 2.9 mg. per 100 cc. respectively; however, the blood phosphatase tests were elevated and confirmed the clinical impression of Paget's disease. Serum acid phosphatase was increased to 5.6 units from a normal of 0.0 to 1.0, and the alkaline phosphatase was increased to 5.14 units from a normal of 1.5 to 4.0.

COMMENT—A man, aged 60, was found to have Paget's disease (osteitis deformans). It was first called to attention by dental symptoms. Diagnosis was suggested by dental roentgenographic observations. Even though this is a comparatively rare disease, oral changes are frequent which makes it a possible problem in oral diagnosis.—*19457 Livernois Avenue.*

■ The Need for Technical Vocabularies

It is an indispensable requisite of science that it should have a recognized technical vocabulary, composed of words so unattractive that loose thinkers are not tempted to use them. . . . I wish you would reflect seriously upon the moral aspect of terminology. *Charles Sanders Peirce to William James.*

Dentigerous cyst of the mandible:
report of case

■ *Charles A. Wilkie, D.D.S., and Sherman E. Gordon, D.D.S., Brooklyn, N. Y.*

Two of the most characteristic features of cysts of the jaw are that they develop slowly and that they are often asymptomatic. Many cysts may reach formidable proportions before onset of any objective or subjective evidence. Often they are discovered only on routine roentgenographic examination. At other times, a persistent noninflammatory swelling is discovered accidentally. Perhaps the best indication of an underlying pathologic condition is an acute infection which involves a long dormant cyst. Pain, if present at all, is at times too vague or insignificant to offer any diagnostic aid. On infrequent occasions, anesthesia may develop when the cyst in its growth impinges on sensory nerve fibers, especially those of the inferior alveolar nerve. In the case to be discussed, that of a dentigerous cyst of the mandible, the patient had noted numbness of the left lateral half of the lower lip and chin for three weeks prior to the onset of acute swelling.

REPORT OF CASE—An apparently well nourished, 58 year old, white man was referred to the authors on April 26, 1954, because of moderately severe swelling over the left side of the mandible that had been present for four or five days. During the three or four week period prior to this first visit, the patient's dentist had performed extractions on several occasions, and penicillin had been administered three times. Occasional pain in the left side of the mandible that radiated to the left temporal region had occurred during the preceding few weeks. This pain had not been severe, however, and had not specifically led the patient to seek professional advice or treatment.

Trismus was present, so the patient could only open his mouth 1 cm. There was tenderness in the left submaxillary lymph nodes. Oral temperature was 100° F.; blood pressure was 140/85, and the pulse rate was 78 and regular.

Intraoral roentgenograms of the left side of the mandible disclosed the presence of first and second molar teeth in normal position, with moderate alveolar recession. A deeply embedded third molar tooth was present. A radiolucent area indicating a pathologic condition was noted in the third molar region; the area apparently extended beyond the confines of the film. Accordingly, a lateral view (Fig. 1) was taken which revealed extensive, apparently cystic, involvement of the mandible. This area of rarefaction, presumably originating around the unerupted third molar, extended posteriorly from a point anterior and inferior to the first molar roots into the ascending ramus, and superiorly into the coronoid process and sigmoid notch. Close examination of the third molar in the film disclosed what appeared to be internal resorption of the anterior half of the crown.

A provisional diagnosis of infected dentigerous cyst was made; however, the possibility of multilocular cyst or adamantinoma was considered, since the roentgenogram seemed to suggest a multilocular structure.

Because of the acute nature of the swelling and infection at the time of the patient's first office visit, an incision to establish drainage was made just posterior to the second molar. Copious drainage of an opaque, brownish exudate was obtained. A length of one-quarter inch iodoform gauze was inserted into the wound and left to serve as a drain. Tetracycline was prescribed in dosage of 250 mg. four times a day.

The drain was changed on April 27 and again on April 29, at which time the swelling had largely subsided. When the patient was seen two days later, however, there was urti-

carial involvement of his arms and ankles. The lesions had appeared on the previous evening. It was learned that the patient had recently been given intramuscular injection of penicillin by his family physician. Antihistamine therapy was begun immediately, and the lesions disappeared within four days. By May 3, the facial swelling was much less prominent, although some intraoral bulging of the ascending ramus was still present. A thin, brown-tinged fluid could be obtained by irrigation through the incision. The patient's temperature had been normal for over 72 hours, and it was decided to enucleate the cyst on the following day.

OPERATION—The operation was performed on May 4 under local anesthesia. Preliminary medication was secobarbital sodium, 1.5 grains. An inferior alveolar nerve block was supplemented by infiltration of the soft tissues overlying the superior portion of the ascending ramus of the mandible. The first and second molar teeth were extracted, after which a vertical incision in the buccal mucoperiosteum was made anterior to the first molar region. The flap was reflected laterally, after which the incision was carried over the crest of the ridge and well up the ascending ramus.

The membrane overlying the unerupted third molar tooth was now visible; the membrane was deficient in part since incision had been made for drainage several days previously. The cystic membrane was dissected away, and the crown of the unerupted third molar tooth came into view. The tooth was deeply positioned and showed no sign of movement after moderate force had been exerted with elevators; therefore, it was necessary to make considerable use of surgical burs before nontraumatic delivery of the tooth could be accomplished.

A small segment of lingual bony plate adhered to the tooth when it was removed. The normal contents of the obliterated mandibular canal could be visualized. The anterior segment of the cyst was exposed by means of a buccal window cut through the cortical plate of the mandible below the level of the sockets of the first and second molars. The posterior cystic mass was carefully separated from its bony

Fig. 1—Preoperative roentgenogram. Note deeply embedded third molar and extent of rarefied area; April 26, 1954

crypt. The suspicion of a multilocular structure was not confirmed. When the excision of the cystic membrane was completed, the wound was irrigated with normal saline solution and the defect was packed loosely with ½ inch iodoform gauze. The incision was closed with interrupted silk sutures, and the free end of the gauze was brought up between the sutures.

MICROSCOPIC EXAMINATION—The pathologist's report on the microscopic examination was as follows: "The cyst is lined with stratified squamous epithelium which is hyperplastic and focally ulcerated. In some areas, there are rather deep dipping rete pegs surrounded by

Fig. 2—Low-power photomicrograph of portion of cyst wall

Fig. 3—Postoperative roentgenogram, July 14, 1954

myxomatous tissue. The fibrous wall contains widespread inflammation, foci of mineralization and evidence of hemorrhage. Diagnosis: dentigerous cyst" (Fig. 2).

POSTOPERATIVE COURSE—On the first postoperative day, pain and swelling were moderate. The patient's oral temperature was 100° F. On the following day, temperature was normal, the swelling extensive but not indurated, and pain was not severe. The packing was removed, the wound irrigated, and a smaller gauze dressing inserted. The patient, at this time, was reasonably comfortable but noted that anesthesia of the lip was still present. The administration of tetracycline was discontinued at this time, since the temperature had been normal for 72 hours. Sutures were removed on the sixth postoperative day; the gauze packing was removed and not replaced. The wound edges were found to be firm and pink and no exudate could be expressed or obtained on irrigation. Pain was absent but paresthesia of the lip persisted. When seen for final observation on July 14, approximately ten weeks postoperatively, the patient was comfortable and free from any disturbing symptoms. Facial symmetry was noted. Objectively and subjectively, involvement of the inferior alveolar nerve was no longer present. Paresthesia of the lip had disappeared some two or three weeks earlier. The operative wound was found to be obliterated (Fig. 3).

DISCUSSION—Although dentigerous cysts occur rather frequently in the mandible, paresthesia, secondary to these cysts, is seldom observed preoperatively. Infiltrative destruction of nerve tissue, as observed when there is malignant involvement of the mandibular canal, is not a prerequisite for production of spontaneous paresthesia. A benign, expansive lesion, such as an interosseus cyst, can by pressure expansion cause paresthesia. In such an event, the nerve and blood vessels are usually found to be displaced from their normal positions. In the case presented, the canal contents were displaced inferiorly, the bony roof of the canal having been obliterated by pressure. The operator must be vigilant when enucleating large cysts of the mandible so as to avoid severing the mandibular nerve and vessels during the excision. It is of interest to note that in the case described, anesthesia of the lip had disappeared by the sixth postoperative week.—*One Hanson Place.*

■ MASTERING A SCIENCE

No one can be really master of any science unless he studies its special history, which again is bound up with the general history of humanity. *A. Comte.*

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The painful temporomandibular joint

THE OBSERVATION by Sicher[1] in this issue that the sensory nerve endings in the temporomandibular articulation occur in the loose connective tissue posterior to the meniscus is of great importance and sheds light on many of the previously misunderstood problems.

Since Goodfriend[2] in 1933 first reported his monumental work on the mandibular articulation followed by Costen[3] in 1934, there has been general interest in this fascinating subject throughout the dental profession. Contributions to the scientific literature in this field have been many and varied and include both laboratory and clinical research. Each has added to the accumulation of knowledge and aided in a better understanding of the problem, which in turn has resulted in a higher percentage of satisfactory results.

Sicher's observation regarding the nerve endings readily explains the immediate relief experienced by patients after meniscectomy, and also gives the reason for the possible recurrence of pain after regeneration of these nerve endings in the postmeniscectomy state. At the same time it completes the clinical picture resulting from bruxism and abnormal dental occlusion. A tension state manifesting itself in bruxism when combined with abnormal occlusion is obviously capable of producing an inflammatory change in the meniscus with resultant edema and compression of the meniscus and the sensory nerve fibers and production of what is clinically recognized as the temporomandibular joint syndrome.

Current trends in treatment are supported by this thesis, giving promise of steadily improving end results. Hydrocortisone, with its specific anti-inflammatory effect when injected into a joint,[4] is capable of temporary reduction of edema, while a more lasting effect is to be anticipated from a program including adequate investigation of the patient's tension state, indicated sedation, occlusal reconstruction and equilibration, and the use of a bite plane to alleviate possible compression of the meniscus during sleeping hours or periods of increased nervous stimulation.

Joints which have developed irreversible changes may be resistant to all forms of conservative therapy. Surgical intervention is indicated for this relatively small group. Because of the tendency toward recurrence of pain after meniscectomy, however, the future trend, in my opinion, will be toward condylectomy of the involved joint. Such treatment is decisive and eliminates the possibility of additional surgery on the joint in the future. In such instances the condylectomy should be performed rather high on the condylar neck, with the bony incision extending in a posterior inferior direction. The meniscus should be allowed to remain in its usual position for it will return to normal health very shortly after the elimination of irritation and compression. Its presence will do much to aid the postoperative rehabilitation of the joint and will contribute greatly to the maintenance of relatively normal occlusion and the prevention of deviation of the mandible during opening movements.

As additional knowledge is accumulated it is hoped that conservative treatment will become increasingly successful. In the light of present knowledge, that objective appears to be within reach.—*Fred A. Henny.*

1. Sicher, Harry. Structural and functional basis for disorders of the temporomandibular articulation. Page 275, this issue.
2. Goodfriend, David J. Symptomatology and treatment of abnormalities of the mandibular articulation. D. Cosmos 75:844 Sept.; 75:947 Oct.; 75:1106 Nov. 1933.
3. Costen, J. B. Syndrome of ear and sinus symptoms dependent upon disturbed function of the temporomandibular joint. Ann. Otol., Rhin. & Laryng. 43:1 March 1934.
4. Henny, Fred A. Intra-articular injection of hydrocortisone into the temporomandibular joint. J. Oral Surg. 12:314 Oct. 1954.

■ The advent of new muscle relaxant drugs requires understanding of these drugs by those engaged in oral surgery. According to theory the sequence of neuromuscular stimuli includes: stimulus with disturbance in polarity and nerve impulse conduction; the production of acetylcholine, which in turn alters muscle end plate potential resulting in contraction, and restoration of normal plate potential by the enzyme cholinesterase.

The muscle relaxant drugs differ in their site of activity in the neuromuscular sequence. Curare is a "competitive" agent which blocks the end plate receptor against the effects of acetylcholine. It has a definite additive effect, and caution must be used in repeat dosages. Succinylcholine (Anectin) replaces the effects of normal acetylcholine and is not destroyed by cholinesterase. It, therefore, prevents end plate depolarization. Since it does affect the end plate receptors, there may be an initial contraction seen as muscular fasciculation immediately after injection. The chief advantage of succinylcholine is its rapid action and elimination, which usually is complete in three minutes. The practical contribution of these synergists to anesthetic procedure has stimulated extensive research.

■ The use of direct interosseous wiring applied through an intraoral approach is becoming increasingly popular in the treatment of mandibular fractures. Difficulty in inserting these wires is sometimes encountered because of limited access from the lingual aspect. After the fracture site is exposed and the holes drilled, a wire threaded through the labial or buccal aspect on one side of the fracture often is difficult to thread back through the hole on the opposite side of the fracture from the lingual surface. This difficulty can be overcome by passing separate wires from the labial or buccal side through the holes on either side of the fracture. The wires are then grasped with mosquito hemostats as they come through on the lingual surface. The wires are brought up into the mouth and the ends are twisted securely together. The other ends of the wires, on the labial or buccal surface, are then grasped and pulled taut. This procedure brings the previously made twist in intimate contact with the lingual surface of the mandible. The two ends on the labial or buccal side are now twisted in the usual manner to stabilize the fracture. The finished wiring has a twist on both the lingual and labial or buccal surface, which in no way interferes with the stability of the immobilization. This procedure overcomes the difficulty of lingual access and eliminates the need for wide lingual exposure since only sufficient space is necessary to allow a hemostat to slide down on the lingual surface to grasp the wires.

■ Teeth that are in close proximity to malignant lesions of the oral mucosa should be extracted with great caution. By removal of the teeth, pathways of extension are opened and on occasion the malignancy will rapidly extend into the sockets and involve the bone. Although extraction of the teeth usually is indicated, there should be close cooperation between the oncologist, roentgenologist and oral surgeon in determining the need for extractions and the optimum time for the procedure.

■ Any submaxillary sialolith that can be detected by intraoral palpation should be removed by an intraoral approach. Even though the sialolith may be in the substance of the gland, its removal through the mouth usually is

Readers are invited to send their clinical observations to the editor, Fred A. Henny, Henry Ford Hospital, Detroit.

feasible. The procedure requires two assistants, one to force the gland superiorly and medially by exerting pressure under the mandible and another to retract the tongue and cheek so the operator may have both hands free. After locating the sialolith by palpation, an incision is made through the mucous membrane in the involved region. Removal is then carried out by freeing the sialolith by blunt dissection. The intraoral approach obviates the necessity for the more radical procedure of removal of the submaxillary gland required by an extraoral approach.

■ Transient Bell's palsy is a phenomenon frequently seen in dental practice in individuals who apparently are predisposed to the condition. The usual history of exposure to drafts and the onset of weakness of the muscles of facial expression on one side is an observation which is not uncommon. Recently a number of examples have been reported in the literature of the beneficial effects of compound F steroid therapy in the ameliorization of this condition. The rationale of treatment is the nonspecific antiinflammatory action of this steroid. One of the theories of explanation of transient Bell's palsy is edema from inflammatory reactions in the region of the trunk of the facial nerve. The rapid return of facial nerve function in a few patients is encouraging.

■ The quantities of vasopressure agents used in local anesthesia in dental practice are well below considerations of toxicity. Occasionally, however, accidents occur in which 1:1,000 epinephrine is mistakenly injected in local anesthesia. Advances in pharmacology have brought forth new compounds, termed "adrenolytic agents," which have been helpful in counteracting epinephrine toxicity. These agents are potent and at present must be handled with great care. Their effect on the cardiovascular system has opened many new fields of investigation in cardiovascular disease. They may throw some light on the problems of differential diagnosis of atypical facial pain which has been attributed to vasospasm.

■ A rather widespread use of diphenhydramine hydrochloride (elixir of Benedryl) has been reported in the treatment of various forms of stomatitis. It is believed to act on symptoms and to be related to the local anesthetic properties of antihistamines as well as to the histamine blockade phenomenon. Varying results are reported, and this topical use of the agents has limitations requiring further clinical investigation.

■ Although numerous warnings have appeared in the literature regarding the utilization of intravenous barbiturates in large scale office practice, an additional comment may prevent an undesirable reaction. Probably the safest precaution in preoperative evaluation of the patient is the history of allergy. Patients who have significant allergies may already have had unpleasant experiences with a barbiturate reaction. Severe asthmatics and individuals with multiple sensitivities should be regarded with caution. The allergic responses to intravenous barbiturates may be alarmingly severe with shock, edema and respiratory embarrassment resulting. Offices equipped for thiopental sodium anesthesia must have facilities and personnel capable of providing effective resuscitation. The utilization of vasopressure agents, antihistamines and steroids for emergency use may be life saving.

■ Removal of Fractured Roots

Q.—In attempting to remove a fractured buccal root tip of a maxillary multirooted tooth, is it better to remove buccal bone or interseptal bone?

A.—The recovery of such a fractured apex is affected by the relations of regional anatomy. With alveolar extension of the maxillary sinus, the hazard of sinus communication in removing interradicular bone must be respected. Otherwise the approach would be determined by the divergence or close approximation of the roots. In many instances, the apex would be covered by a very thin layer of buccal bone, and the removal of buccal bone would be most conservative and therefore most acceptable.

■ Cystlike Mandibular Lesion

Q.—A 60 year old patient has a cystlike radiolucent area 1.5 cm. in diameter, near the angle of the mandible adjacent to the inferior alveolar canal. The mandible is edentulous posteriorly, and there are no clinical symptoms. Should the region be investigated surgically?

A.—This is a region in which one is apt to find developmental defects in the osteogenesis of the mandible. This condition has been reported in the literature as a persistence of primitive cartilage in the formative stages of the mandible. Although developmental defect is the most probable diagnosis, one must not exclude other important possibilities in differential diagnosis. These possibilities include odontogenic cysts and neoplastic disease both primary and metastatic. Because of the negative history and total asymptomatic course, it is probably best to keep the region under observation with periodic roentgenographic evaluation of the region of involvement.

■ Atresia of the Submaxillary Duct After Sialolithotomy

Q.—A patient was seen who had typical obstructive symptoms from a submaxillary sialolith which was located roentgenographically near the terminus of the submaxillary duct. The removal of the stone was simple, and the relief of symptoms prompt. However, two days after the removal of the stone, the patient again had obstructive symptoms. No saliva could be expressed from the duct orifice or the operative site. What are your suggestions?

A.—The problem appears to be atresia of the duct after the surgical intervention and the inflammatory reaction in the region. Assuming that no other sialolith may be demonstrated in the gland or that there is no arborization of the ductal system we would assume the reaction to surgery to be the sources of the residual obstruction. In such instances it has been found helpful to maintain the lumen of the duct through the insertion of a fine polyethylene tube in the terminal half of the duct, maintaining the tube position by fine suture in the floor of the mouth. After the tube has been in position for four to six days, there usually is sufficient healing for maintenance of the ductal lumen.

■ Posterior Tongue Lesion

Q.—A patient has a bluish lobulated mass of tissue located laterally at the root of the tongue. The mass is entirely asymptomatic. There is no

This section devoted to queries and comments from readers on topics of current interest to oral surgeons and general dental practitioners is edited by James R. Hayward, University Hospital, Ann Arbor, to whom readers are invited to send their communications. The answers, prepared by competent consultants, do not necessarily represent the opinions of any official scientific organization. Your participation in this section is invited.

The Editor

history of bleeding or ulceration in the region. What are the possibilities to be considered in diagnosis?

A.—The description of the lesion suggests the possibility of congenital abnormality with the presence of aberrant thyroid tissue. Although the lingual tonsil on occasion may undergo hyperplasia and assume prominence, the lateral location of a projecting lobulated lesion of this type is one of the locations of aberrant thyroid tissue. A biopsy is the only known means to confirm the tentative clinical impression of this lesion.

■ Mixed Tumor of the Palate

Q.—A 65 year old patient has an asymptomatic hard swelling at the junction of the hard and soft palate to the left of the midline. The lesion is not painful, and the overlying mucosa appears to be distended but has a normal surface. Biopsy has shown the lesion to be "a pseudoadenomatous variant of mixed salivary gland tumor." What is the prognosis and indicated treatment plan for this lesion?

A.—The palate region is a relatively common site for location of mixed salivary gland tumors, a location second only to the major salivary glands. Although there is only theoretical knowledge of the etiology, many of these tumors are well encapsulated and follow a benign course. Opinion is usually reserved regarding the possibilities of a change to adenocarcinoma. The so-called "pseudoadenomatous variety" usually refers to the type of lesion which has a tendency to persist and has been reported to produce pulmonary metastases. It is therefore recommended that this lesion be completely excised with an adequate margin. The location presents problems in reconstruction which may not be totally correctible. The possible need for an obturator must be considered.

■ Hormonal Imbalance

Q.—A patient referred for multiple extractions is being maintained on extensive endocrine therapy after removal of the pituitary gland for a malignancy. What precautions may assure satisfactory tolerance of the contemplated extractions?

A.—This patient has a primary deficiency in major hormonal balance which is under constant medical surveillance and therapy in order to sustain life. It is therefore important that through close cooperation with the endocrinologist the patient be prepared adequately for the stressful situation entailed in the extraction. Preoperative preparation will be advised, and increased dosage of compound E or F probably will be recommended in the preoperative, operative and postoperative stages of the procedure.

■ PATHOLOGY FOR STUDENTS OF DENTISTRY. By George L. Montgomery, M.D., Ph.D. 305 pages with 133 illustrations and 10 color plates. Index. Price $7.50. Baltimore, Williams & Wilkins Co., 1953.

This book covers the course in general pathology for undergraduate dental students at the University of Glasgow. Even though the content is limited to the principles of general pathology, the book contains two chapters dealing solely with mouth changes. One of these chapters deals with inflammations of the mouth and jaws and one with neoplastic and cystic conditions of tooth rudiments.

A number of opportunities to use mouth alterations as examples of general conditions have been used to good advantage. For example, the complete replacement of a child's jaw after loss by necrosis is used to explain the process of regeneration.

The illustrations vary from good to bad. The paper, type, printing and binding are excellent. In spite of the book's size the coverage is surprisingly inclusive, and it is no less remarkable that there seems to be no omission of essential subjects. It is a well prepared, authoritative, concise volume.—*Edward H. Hatton.*

■ PRACTICAL ORAL SURGERY. By Henry B. Clark, Jr. First edition. 392 pages with 223 illustrations. Index. $8.50. Philadelphia, Lea & Febiger, 1955.

The title of the book is well chosen, for it successfully describes the contents of this excellent new text in oral surgery. Although it is not nearly as voluminous as other books that are available, it compensates for this by its high degree of organization and the concise nature of presentation of the subject matter. It has been written primarily for undergraduate students, and the author carefully points out their specific educational objectives in the first chapter. However, the book is of such character that graduate students and dentists in active practice also will find it of benefit in their studies.

Sixteen chapters are included. A specific feature of each chapter is a vocabulary of terms that apply to the subject matter included in that portion of the book. Illustrations are generous throughout. These include actual clinical photographs as well as line drawings and tables. The general quality of the illustrations is excellent.

The author includes an important chapter on the seven minimum essentials for basic operating conditions as used in actual clinical practice at the University of Minnesota. These essentials are well conceived and offer an important standard for all surgeons to follow.

Chapters on preoperative evaluation of the patient, contributing medical conditions and asepsis and sterilization are covered in a concise fashion. Basic oral surgery technic and postoperative care also are covered in a manner that is inclusive yet devoid of excessive verbiage and discussion.

The concluding chapter, "The Art of Practice," is a reflection of the author's philosophy of practice and professional life. It contributes greatly to the personal appeal of the book and lends importance to its presence in the student's library.—*Fred A. Henny.*

■ CIRUGIA BUCAL. By Guillermo A. Ries Centeno. Fourth edition. Two volumes. 1,054 pages. Buenos Aires, Libaeria Elateneo Editorial.

This is the fourth edition of this Spanish language book since its publication only ten years ago, and it is easy to understand the popularity which this manual of oral surgery has enjoyed.

The book is organized with great thought, so that the reader is taken in an orderly fashion from basic fundamentals of oral surgery, such as the anatomy involved, to the details of the more complicated procedures.

Each volume is divided into major parts. Volume I includes the anatomy of the jaws, surgical technics, anesthesia, both local and general, and exodontics. The second volume deals with apicoectomies, inflammatory processes of the jaws (including osteomyelitis and osteitis), surgery in relation to prosthetics and orthodontics, oral and antral communications, tumors of the jaws and cysts of the jaws. Two major fields of oral surgery have been omitted, traumatic injuries and malignancies. These omissions are all the more noticeable because of the excellent coverage of other aspects of oral surgery.

The text is profusely illustrated with photographs and drawings, all of which are excellent. The type and paper make for easy reading. The volumes, received for review, however, are bound in paper which might not withstand the frequent use which they should enjoy. As a basic text, in Spanish, for students and general practitioners, this book is heartily recommended.—*Marvin Revzin.*

■ A METHOD OF ANATOMY, DESCRIPTIVE AND DEDUCTIVE. By J. C. Boileau Grant, M.C., M.B., Ch.B., F.R.C.S. (Edin.). Fifth edition, 870 pages with 862 illustrations. Index. Price $7. Baltimore, The Williams & Wilkins Co., 1952.

Since the first edition of this book was published in 1937, it has gained more and more influence in the teaching of anatomy. The basic idea that teaching and studying anatomy should be a process of reasoning and understanding, instead of thoughtless memorizing, is kept alive throughout this whole book.

The arrangement of the material is, therefore, regional, and the emphasis is on anatomic relations and on a functional analysis. Of course, there are some weaknesses inherent in such a venture, the most important being an unequal treatment of the different parts.

Even in a book as good as Grant's, the text contains some erroneous statements. Some examples may be quoted.

Despite Brash's madder experiments, sutural growth of the cranium is an indisputable fact. The growth of the femur is not due to the extensive remodeling as Figure 14 would indicate, but is mainly due to the growth of the distal epiphysis. It seems an inappropriate choice of words to state that the synovial joints of the limbs, permitting free movements, make for "insecurity." The term "anastomoses" for the connections of nerves leads to many wrong inferences, and should not be applied.

Figure 166 gives an incorrect picture of the function of the interossei and lumbrical muscles, which flex the metacarpophalangeal joints, while extending the interphalangeal joints. The action of the mandibular muscles (see also Table 23) is incorrectly described in many points. The medial (internal) pterygoid muscle does not protrude the mandible, but merely fixes it in protrusive position. The posterior part of the temporal muscle does not shift the chin to the same side, but fixes the "resting" condyle, while the other moves forward, downward and inward; finally the deep masseter, digastric and geniohyoid muscles are omitted as retractors of the mandible.

The specific mention of mistakes in the review of a book sometimes creates the wrong impression—that the reviewer is eager to look for, and to criticize such errors. Nothing would be more unfair, provided that the book under review is a worthwhile contribution to the field of science and teaching, and it can be said without equivocation, that Grant's text belongs in this category.—*Harry Sicher.*

■ THE SURGICAL TREATMENT OF PROGNATHISM. Varaztad H. Kazanjian. Am. J. Surg. 87:691 May 1954.

Prognathism of the mandible may be classified into three groups according to the relative development of the mandible and maxilla. The first group is characterized by a normal maxilla with a regular dental arch but with an abnormally enlarged mandible causing overprominence of the lower one third of the face. The second group is characterized by overdevelopment of the mandible and an accompanying underdevelopment of the maxilla. The third group is composed of those cases in which overdevelopment of the mandible may not be pronounced but an open bite is the most outstanding malocclusive feature.

A number of operative procedures have been advanced, but there are only two that are widely used today. One approach is that of resecting a measured portion of bone from each side of the body of the mandible and immobilizing the anterior segment in its new position. The second approach is that of osteotomy through the rami above the level of the mandibular canals and retropositioning the lower fragment to the desired occlusion where it is immobilized.

This operation may be performed by either the closed or open method. The closed method consists of passing a Gigli saw with a directing instrument along the inner surface of the ramus above the lingula, through two small openings, one in front of the ear and the other below the zygoma, and cutting the bone blindly with the saw. The open method consists of direct exposure of the ascending ramus through an incision about 1½ inches long at the posterior border of the angle of the mandible. The lateral surface of the ascending ramus is then sectioned under direct vision. Neither operative approach can be condemned, for each has its place.

Both osteotomy and ostectomy of the mandible will give good results if used properly, and the choice of operation can be determined only by a careful study of each individual case prior to surgery. A serious complication is the gradual development of an open bite or a gradual forward thrust of the lower jaw which occurs despite apparent consolidation of the bones. These conditions have occurred only in those patients in whom the rami were sectioned, and there is no doubt that the pull of the powerful muscles of mastication against the lower mandibular fragment is the cause of such unfavorable results.

A new technic for avoiding this consists of exposing the lateral surface of the ramus through an incision below the angle of the jaw according to the Risdon technic. Instead of cutting through the bone with a dental bur at a right angle to the surface above the level of the mandibular canal, the bone is cut transversely with an osteotome on a broad slant in order to allow for ample contact area of the cut ends. This beveled cut serves three purposes: (1) it affords a greater contact area between the fragments; (2) it avoids the inferior alveolar nerve, and (3) it prevents any possible medial displacement of the upper fragments by the pull of the internal pterygoid muscles.

Some prognathic cases also are associated with open bite. For maximum success in such cases resection of bone from the body of the mandible is recommended. Attempts at repair by osteotomy of the ramus in such cases have at times been discouraging as there is a tendency for the bite to open postoperatively. This is due to the fact that the masseter and internal pterygoid muscles must be stretched in order to close the bite by this method and that these muscles, exerting tremendous force in their stretched condition, cause the anterior portion of the lower fragment to move downward in a lever type action, with the posterior teeth acting as a fulcrum. Resection of a portion of the body of the mandible bilaterally obviates this difficulty. —*Myron Kaufman.*

■ EXTENDED USE OF DICED CARTILAGE GRAFTS. Lyndon A. Peer, M.D. Plast. & Reconst. Surg. 14:178 Sept. 1954.

Diced cartilage grafts were first devised and used by the author in skull depressions. Since then, such grafts have been used to repair mastoid fistula, to build out prominence of the malar bone, to correct receding chin and to restore contour as a filler substitute for bone grafts in many places where normal bone contour is lacking.

These grafts should not be used to provide continuity in a movable bone, because the cartilage joins its host bone by fibrous union rather than by osseous scar. For this reason, however, their use to repair ankylosis of joints is suggested. A sheet of tantalum mesh or stainless steel screen may be sutured over the defect to maintain contour of the diced cartilage. The diced cartilage will become bound together and to the mesh by connective tissue.

The entire procedure is based on a physiological principle. There are numerous dead spaces between the individual diced cartilage segments, and fibroblasts, with their accompanying blood vessels, will always grow into these spaces and fill them with collagenous fibers and cement substance. These substances when dry (after about five months) provide a strong binding material which holds the individual cartilage segments firmly together. Although cadaver bank cartilage grafts usually are well tolerated by human tissues, autogenous tissues as free grafts are preferred. Preserved diced cartilage grafts showed definite invasion and absorption in some grafts while the tendency to bone formation was more pronounced in preserved cartilage.—*Myron Kaufman.*

■ METASTATIC MALIGNANCY OF THE JAWS. S. Gordon Castigliano and C. Jules Rominger. Am. J. Surg. 87:496 April 1954.

Metastatic malignancy from a distant primary site involving the jaws, although rare, is worthy of special attention. Metastatic malignancy involving the jaws should be emphasized as a possibility in the diagnosis of jaw neoplasms in order to spare a significant number of patients with occult malignancy the tragedy of useless disfiguring radical surgery. It is likely that at least 100 instances of jaw metastasis from distant occult carcinomas could be seen in this country every year. Indeed, with increasing awareness of the possibility, the number of cases reported is growing.

Jaw metastasis is sharply distinguished from invasion of the mandible by oral malignancy, which occurs with relatively great frequency. Other workers describing and reporting metastasis to the jaws from primary intraoral carcinoma have not critically differentiated between direct invasion and metastasis. In some cases jaw metastasis may be the first and only symptom of malignant disease elsewhere in the body. Usually, however, if the mandible is involved, there is detectable metastatic disease elsewhere.

The possibility of multiple primary carcinomas when one carcinoma involves the jaw always should be considered. Obviously the prognosis in this case could be better than the case in which the oral lesion is metastatic from a distant primary site. In the first instance, each case of malignancy occurring at the same time in the same patient would have to be evaluated on its individual merits. In the latter case the patient has widely disseminated metastasis and the condition is hopeless.

A review of the literature from 1902 to 1953 revealed a total of 176 cases of metastatic malignancy involving the jaws. The primary lesions most frequently accounting for jaw metastasis were carcinoma of the thyroid, hypernephroma, carcinoma of the breast, carcinoma of the lung and carcinoma of the prostate.

A complete and accurate history of present symptoms, past illnesses, a systemic review and complete physical examination are essential to correct diagnosis. Adequate biopsy is essential and should be interpreted by a competent tumor pathologist. Treatment should consist only of palliative roentgen therapy to reduce the size of the lesion and relieve pain.

The first known case of seminoma of the testis with mandibular and maxillary metastases as the presenting symptoms is reported.—*Myron Kaufman.*

■ THE PROBLEM OF THE CLEFT PALATE FACE. Wilton M. Krogman, Ph.D. Plast. & Reconst. Surg. 14:370 Nov. 1954.

The postnatal growth pattern of the cleft palate face does not differ from that of the normal face; growth proceeds in keeping and in harmony with the basic deviation initially introduced by the cleft. There may be a difference in timing (retardation).

Surgical procedure performed too early may inhibit postnatal growth potential in transverse palatal growth. This assumption is based on the established loci and planes of faciodental growth. The precise degree to which surgery affects growth is not amenable to generalization in terms of "averages"; each case is unique, and the relationship must be established individually on a follow-up basis.

An optimum time for surgical procedure which, both in theory and in practice, would be in accordance with growth dimension and growth potential, is somewhere between four and six years of age, with the earlier age acceptable in the great majority of cases. However, if the growth tempo in the individual child is such that there is evidence of advanced growth, it is possible that an earlier age for surgery is permissible.—*I. A. Small.*

■ THE FAMILIAL DISTRIBUTION OF CONGENITAL CLEFTS OF THE LIP AND PALATE. F. C. Fraser and H. Baxter. Am. J. Surg. 87:656 May 1954.

Although much has been written on the subject, little is known of the causes of congenital defects. The best that can be done is to state a statistical probability that a child will or will not be affected, a prediction based on the observed frequency of clefts of the lip and palate in siblings. Fogh-Andersen has provided figures suitable for this purpose based on his studies of the Danish population.

The purpose of the present study was to establish whether the results of Fogh-Andersen could be applied to the Canadian population. This preliminary report deals with the families of 102 clinic patients with congenital clefts of the lip or palate or both. The results are as follows: (1) The chances of a child's being born with a congenital cleft of the lip or palate is about 5 per cent when either a parent or a sibling is affected and about 15 per cent when both a parent and a sibling are affected. (2) The risk of occurrence of the defect in a sibling of the proband (a proband is the affected family member visiting the clinic) is 6.4 per cent in the case of the cleft lip with or without cleft palate, and 3 per cent in the case of cleft palate. (3) The isolated cleft palate is a genetically different entity from the cleft lip, with or without cleft palate.

Analysis of the antenatal histories has not led to the identification of any relevant etiologic prenatal factors as yet. The use of these observations in genetic counseling is discussed.—*Myron Kaufman.*

■ MANDIBULAR CONDYLE FRACTURES. Thomas Ray Broadbent, M.D. Plast. & Reconstruct. Surg. 14:148 Aug. 1954.

The use of nasomandibular fixation for fractured condyles in children and edentulous adults is advocated.

Using a trocar or preferably a no. 18 spinal needle, a single no. 25 gauge stainless steel wire is placed circumferentially around the mandible in the midline. An incision is made beneath the upper lip in the midline and adjacent to the buccolabial sulcus. The soft tissue over the nasal spine is elevated, the spine exposed and perforated with a small bur, Kirschner wire or bone drill point. The hole is placed near the base of the spine in order to avoid the cartilaginous portion of the nasal septum.

This procedure is particularly important in children whose nasal spine may not be very large. The mandibular wire or a similar one is placed through the perforated nasal spine and the mucosal incision closed with two or three sutures of no. 000 catgut. The wire is twisted tight, bringing the mandible into occlusion. The single wire may be tightened as needed and immobilization maintained for four to five weeks.—*Irwin A. Small.*

■ CHIN IMPLANTS. D. Ralph Millard, Jr., M.D. Plast. & Reconstruct. Surg. 13:70 Jan. 1954.

Many large noses are being reduced and recontoured without correction of a receding chin. Human rib cartilage is preferred for chin implants and is banked as described by Brown and DeMere. In the correction of a receding chin, bilateral mental block and infiltration anesthesia is used. An incision is made in the lower buccal sulcus about 1 cm. from the alveolus so that a mucosal flap edge is preserved for closure. The incision is carried under the chin pad but superficial to the mandible, keeping soft tissue on the bone until the future site of the implant is reached. At this point the incision is carried down to bone except in the region of the mental foramen where the scalpel is kept slightly more superficial. An exact pocket is dissected so that there will be no chance for the implant to slip.

Closure is obtained by suturing in two layers, using fine plain catgut. A pressure dressing is applied to close off the lower buccal sulcus for 24 hours, thus avoiding saliva seepage into the pocket.—*Irwin Small.*

■ FACE INJURY IN SPORT. John Gerrie, M.D. Plast. & Reconstruct. Surg. 14:224 Sept. 1954.

A survey has been made on the etiology, treatment and management of face injuries occurring from sports. The distribution of 150 injuries is as follows: nose, 63 per cent; mandible, 17 per cent; cheek bone, 14 per cent; zygomatic arch, 2 per cent; soft tissue, 3 per cent. Considerable delay in presentation of the patient for treatment was a startling observation of the study. Some 42 per cent of the patients appeared for late or secondary treatment more than five days after the time of injury. There is a problem of when to allow the player to return to active sports participation, and a fairly definite policy can be formulated based on the region injured. If a player is treated within the first 24 hours for a broken nose, cheekbone or zygomatic arch, and the injury is reducible and can be maintained without external splinting, he can be back in play in ten days.

This return to sports is, of course, not possible with a fractured mandible when the jaws are wired in occlusion. Splints can be removed after the fourth week and full participation resumed at the fifth to sixth week. There is no indication for face protection by protective headgear after injury other than in hockey and football.

In other sports, the player will have a protective reflex reaction sufficient to protect or favor the injured part. Headgear, when used, should be designed with an understanding both of the underlying anatomy and of the principles of face injury and should be so constructed that it could not contribute to the injury of another player.—*Myron Kaufman.*

■ AUTOGENOUS BONE TRANSPLANTS IN HUMANS. Lyndon A. Peer, M.D. Plast. & Reconstruct. Surg. 13:56 Jan. 1954.

Human autogenous septal, nasal and turbinate bone grafts, without periosteum, retain their calcified matrix after transplantation in soft tissue sites, and the bone cells remain viable up to five years. Other facial bones and the cranial bones may have this same quality.

Human autogenous rib, tibial and iliac bone grafts, with and without periosteum, after transplantation in soft tissue sites are absorbed and replaced by host fibrous tissue. The bone cells in the graft remain viable until their calcified matrix has been removed. They then disappear in the multitude of invading fibroblasts.

Experimental work indicates that the cells in autogenous bone grafts (other than dense cortex) in contact with bone tend to survive transplantation en masse and retain their calcified matrix. Bony union between graft and host bone is by callus formation at points of contact such as occurs in the healing of fractures. In regions where absorption of an autogenous bone graft is taking place, the predominant cell and often the only cell present is the fibroblast, which is accompanied by numerous blood vessels.—*Irwin Small.*

■ THE ROLE OF THE ORTHODONTIST IN A CLEFT PALATE TEAM. Samuel Pruzansky, D.D.S., M.S. Plast. & Reconstruct. Surg. 14:10 July 1954.

The orthodontist on the cleft palate team assumes a double responsibility. His primary obligation is to provide orthodontic treatment for the patients entrusted to his care. Secondly, he can apply the knowledge and diagnostic tools employed in orthodontics to the solution of problems in related spheres.

The normal function of the mimetic and lingual musculature is dependent on the symmetry of the facial skeleton, the dental arches and the palatal vault. In the child with a cleft lip and palate, the symmetry of form and muscle balance may be altered. In order to provide the optimal circumstances for the development of articulate speech, the early restoration of skeletal symmetry through oral orthopedic means is suggested. It is proposed that this procedure be undertaken when the child is as young as three years of age.

Orthodontic therapy in the child with a cleft lip and palate permits the expansion and rotation of the maxillary segments. Movement of bony segments is best achieved in the young patient and in the absence of binding scars or arrested skeletal development. Orthodontic therapy is a relatively painless procedure and does not inhibit the growth of the structures manipulated. Malposed and overlapping palatal processes, characteristic of many repaired clefts, serve to obstruct the nasal cavity and impede the growth of the alveolar process and the eruption of teeth.

Early restoration of a more normal palatal architecture is conducive to normal growth and function. The expansion of the nasal cavities achieved by orthodontic means improves nasal ventilation and promotes the health of the upper respiratory tract. Cephalometric roentgenography provides a valuable tool in the analysis of the structures of the nasopharynx and in the study of velopharyngeal function. The orthodontist's increasing familiarity with cephalometric roentgenography permits him to give diagnostic information to the surgeon, the pediatrician, the otolaryngologist and the speech pathologist. Enthusiasm for the new trends in the surgical repair of cleft palate can now be subjected to the exacting scrutiny provided by these methods, thus offering an opportunity to replace opinionated dogma by science.—*Myron Kaufman.*

■ THE CRANIAL BASE AND SOFT STRUCTURES IN CLEFT PALATE SPEECH AND BREATHING. Robert M. Ricketts, D.D.S., M.S. Plast. & Reconst. Surg. 14:47 July 1954.

Midsagittal laminagrams of 20 children aged 12½ were studied. Ranges of variation were established for the size and form of the nasopharyngeal hard and soft structures. These observations were employed as a yardstick for the comparison of cleft palate and mouth breathing conditions. Although these observations are only preliminary, it appears that the method is adequate for the evaluation of the nasopharyngeal spaces, and perhaps standards at various age levels should be established. Nasal emission in speech appears to be related to the condition of the region upward and slightly backward of the middle third of the soft palate. Large spaces at that location contribute to "barrel" or "hollow" sounds in speech even in the presence of well functioning soft palates.

In an opposite manner, excessive adenoid tissue appears to be a contributing factor in mouth breathing only because space is limited at this critical region. In this regard the position of the posterior nasal spine to the adenoid tissue is of primary concern. Conditions of the nasopharynx should be evaluated from a standpoint of the relationship and adequacy of all the structures that contribute to its size, shape and function.

This evaluation should include: (1) the angulation of the cranial base (occipital, sphenoid and ethmoid bones), (2) the position of the posterior nasal spine, (3) the size of the soft palate, (4) the range of function of the soft palate and (5) the amount of adenoid tissue. Abnormalities of two or more of these conditions were often present simultaneously in patients with speech disorders or respiratory problems.—*Myron Kaufman.*

Announcements

■ American Society of Oral Surgeons to Meet in October

The American Society of Oral Surgeons will meet October 11-14 in Los Angeles. Harry M. Seldin is president of the group.

■ Oral Surgery Definition of A.M.A. Remains Unchanged

The House of Delegates of the American Medical Association at its annual session June 6-10 in Atlantic City, N. J., reaffirmed the definition of oral surgery adopted by it in June 1953. In so doing, the delegates ignored a recommendation of the A.M.A. Board of Trustees that the definition be rescinded.

The American Dental Association through its Special Committee on Problems in the Field of Oral Surgery had been negotiating with the A.M.A. trustees for a definition acceptable to the dental profession and had obtained the support of the A.M.A. trustees for the position of the dental association. At the annual session, however, the A.M.A. reference committee overruled the trustees, and the reference committee recommendation passed the House without further comment from the trustees.

The Special Committee on Problems in the Field of Oral Surgery of the American Dental Association has taken the position that medicine's effort at a definition of oral surgery is both needless and ineffective since the rights of the dentist in oral surgery are determined by state statute and not by the pronouncements of the medical profession.

■ More than 4,200 Subscribe to Dental Abstract Journal

More than 4,200 subscriptions, including a number from other countries, have been received for DENTAL ABSTRACTS, the new Association journal, according to John J. Hollister, business manager. The new journal, which will start publication with the January 1956 issue, will contain summaries of articles from all important dental publications in the world. The magazine will enable the practicing dentist to have at his fingertips the latest developments in dental science and practice.

Domestic subscriptions are $6; foreign subscriptions, $7. Subscriptions may be obtained from the American Dental Association Subscription Department at the Central Office.

■ Oral Surgery Section Plans Symposiums for Annual Session

A symposium on roentgenographic and pathologic interpretation of lesions of the oral cavity and a panel discussion on the use of local and general anesthesia in oral surgery are planned by the Section on Oral Surgery and Anesthesia for the 96th annual session of the American Dental Association. The annual meeting is October 17-20 in San Francisco. Participating in the symposium will be Hamilton B. G. Robinson of Columbus, Ohio; Richard W. Tiecke of Chicago, and Francis V. Howell of Portland, Ore.

Panelists discussing the use of anesthesia in oral surgery are Edward C. Thompson of Urbana, Ill.; Harry M. Seldin, of New York; Stanley C. Harris, Ph.D., of Chicago, and R. Quentin Royer of Rochester, Minn.

The scientific program of the annual session includes projected clinics, table clinics, motion pictures and exhibits of interest to oral surgeons.

In addition, a varied entertainment program has been planned which includes visits to points of interest in this colorful West Coast city. Preconvention and postconvention tours have been scheduled by a number of organizations.

■ Hawaii Conference Combines Science and Social Events

The Pan-Pacific Dental Conference to be held in Hawaii October 24 and 25 under the sponsorship of the Honolulu County Dental Society combines a scientific meeting with a varied entertainment program. Planned for dentists who wish to combine a Hawaiian vacation with attendance at the conference, the meeting has been scheduled also for the convenience of those attending the American Dental Association's annual session in San Francisco October 17-20. Included in the entertainment program is a special tour of the Island and a luau (Hawaiian-style feast).

Information on the conference may be obtained from the Pan-Pacific Dental Conference, 3124 E. 14 St., Oakland 1, Calif.

■ General Anesthesia for the Ambulatory Dental Patient Subject of October Meeting

General anesthesia for the ambulatory dental patient will be the subject of a panel discussion at the October 24 meeting of the American Society for the Advancement of General Anesthesia in Dentistry. The meeting will be at the Hotel Shelburne in New York.

On the panel are Morris Fierstein, director of dentistry, Tri-Borough Hospital in Jamaica, N. Y.; Anthony Mecca, visiting dentist, Bellevue Hospital; Arthur J. Follenius, anesthetist, Staten Island Hospital, and Alvin L. Solomon, instructor in general anesthesia, School of Dental and Oral Surgery, Columbia University.

■ Oral Soft Tissue Is Topic of Dental Medicine Meeting

A symposium on the oral soft tissue in health and disease is a feature of the December 4 meeting of the American Academy of Dental Medicine scheduled for the Hotel New Yorker in New York City. Participating will be Edward V. Zegarelli of New York; Hamilton B. G. Robinson of Columbus, Ohio, and Lester W. Burket of Philadelphia. Reservations may be obtained from George J. Witkin, national secretary, 45 S. Broadway, Yonkers 2, N. Y.

■ American Institute of Dental Medicine Meets in October

October 23-27 are the dates of the next annual meeting of The American Institute of Dental Medicine. The meeting will be held at the Desert Inn, Palm Springs, Calif. On the faculty will be Maury Massler, University of Illinois; Valy Menkin, M.D., Temple University Medical School; Hans Selye, M.D., University of Montreal; Reidar F. Sognnaes, D.M.D., Harvard School of Dental Medicine, and Wendell L. Wylie, University of California.

Applications and full information on the meeting may be obtained from Miss Marion G. Lewis, 2240 Channing Way, Berkeley 4, Calif.

■ Otto Brandhorst Honored by Virginia School

Otto W. Brandhorst, president of the American Dental Association during 1951-52 and one of the nation's outstanding dental leaders, was awarded the honorary degree of Doctor of Science at the annual commencement exercises of the Medical College of Virginia in Richmond May 31. Dr. Brandhorst served in May as an adviser to the official United States delegation to the Eighth World Health Assembly in Mexico City.

Recently he served as a member of the Task Force on Medical Services of the Commission on Organization of the Executive Branch of the Government, commonly known as the Hoover Commission. Dr. Brandhorst currently is chairman of the Association's Special Committee on the Survey of Dentistry.

■ Internship, Residency Offered By Alabama School

The University of Alabama School of Dentistry and the University Hospital offer a one year internship in oral surgery as part of a three year program leading to Board eligibility in oral surgery. An assistant residency is offered also by the hospital and school, in conjunction with the Veterans Administration Hospital in Birmingham.

Information on both programs may be obtained from Joseph P. Lazansky, D.M.D., associate dean, University of Alabama School of Dentistry, Birmingham 3, Ala.

■ School Offers Course for Practicing Oral Surgeons

Loyola University School of Dentistry (Chicago) announces a course in oral surgery October 10-14 under the direction of Joseph Kostrubala. Infection, trauma, neoplastic diseases and congenital deformities will be considered in the course which is limited to practicing oral surgeons. Students will perform various types of operations on cadavers.

■ Mount Sinai Hospital Accepting Applications for Internships and Residencies

The department of dental and oral surgery of the Mount Sinai Hospital in New York announces that it is accepting applications for internships and residencies for the year beginning July 1956. Interviews will be held in the fall of this year.

■ Harold Matteson Installed as Societies' President

Harold M. Matteson of Palo Alto was installed as president of the Northern and Southern California Societies of Oral Surgeons at their annual meeting in June. Installed as president-elect was Ray J. Weinheimer of Oakland. The secretary-treasurer is John R. Edrington of Palo Alto.

Other officers are Victor I. Garfinkle, Albert H. Throndson, James R. Bullard, Arthur J. Hemberger and Erwin W. Ferber, board of directors; Ray J. Weinheimer, program committee chairman; Wilber Wirtz, membership committee chairman, and John P. Roffinella, arrangements committee chairman.

Editorial communications

■ ORIGINAL COMMUNICATIONS—This journal invites concise original contributions in the broad field of clinical and experimental surgery of the mouth and associated structures, including roentgenology, diagnosis, anesthesia and oral surgical pathology. Articles are accepted for publication with the understanding that they are contributed solely to the JOURNAL OF ORAL SURGERY. All manuscripts are subject to editorial modification. Neither the editors nor the publishers accept responsibility for the views and statements of authors expressed in their communications.

■ MANUSCRIPTS—Manuscripts submitted for publication should be sent to Fred A. Henny, Editor, Henry Ford Hospital, Detroit, Michigan.

Manuscripts should be typewritten on one side of the paper only with double spacing and liberal margins. The author's name and the abbreviated title of the article should appear at the top of each manuscript page. The original should be sent to the editor and a carbon copy retained by the author. Manuscripts will not be returned if accepted for publication.

References should be placed at the end of the article and should conform to the style of the Quarterly Cumulative Index Medicus; viz., name of author, title of article and name of periodical with volume, pages, month and year. They should be numbered and should appear in the same order as that of the superior figures inserted in the appropriate positions in the text.

■ ILLUSTRATIONS—Illustrations accompanying manuscripts should be unmounted and numbered. The author's name should appear on the margin or back.

Authors should insert figure numbers at appropriate places in the text. The original drawings, or glossy print photographs of them, should accompany the manuscript. Legends for illustrations are to be typewritten in a separate list with numbers corresponding to those on the photographs and drawings.

A reasonable number of halftone illustrations will be reproduced free of cost to the author, but special arrangements must be made with the editors for color plates, elaborate tables or extra illustrations. Copy for zinc cuts (such as pen drawings and charts) should be drawn and lettered in India ink or with black typewriter ribbon (carbon paper placed with carbon against back of sheet for bolder type). Ordinary blue or colors will not reproduce. Only good photographic prints or drawings should be supplied for halftone work.

■ CASE REPORTS—Case reports will constitute an important department of the journal and the editors welcome case reports that are of unusual clinical value or that present exceptional conditions of interest.

■ EXCHANGES—Letters, exchanges, reprints and all other communications relating to the JOURNAL OF ORAL SURGERY should be sent to the American Dental Association, 222 East Superior Street, Chicago 11.

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